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THE
ANATOMY OF KNOWLEDGE

AN ESSAY IN OBJECTIVE LOGIC

BY
CHARLES E. HOOPER



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CORRIGENDA

- P. 56, § 15, second par. *For* "has continuity in time" *read* "exists at one point or during one unbroken period of time."
- P. 81, third par. *For* "unity of extension" *read* "some singular object."
- P. 84, line 11. *For* "innermost"—"outermost" *read* "next inner—next outer one."
- P. 86, footnote, third line from bottom. *For* "object" *read* "objects."
- P. 127, fourth line from top. *Delete* "italicised."



INTRODUCTION

WHILE the deductions of mathematics and the discoveries of physical science carry conviction to the thinking world, it would seem that the problems of philosophy are ever being propounded anew, and are never solved except to the satisfaction of particular schools or sects.

One remembers how Milton's dialectically-disposed devils

"reasoned high
Of providence, foreknowledge, will, and fate,
Fixed fate, free-will, foreknowledge absolute,
And found no end, in wandering mazes lost."

And, possibly, with the less austere poet, one congratulates himself on having outgrown all such disputatious wisdom :—

"Myself when young did eagerly frequent
Doctor and Saint, and heard great argument
About it and about : but evermore
Came out by the same door where in I went."

Yet Milton, in the Third Book of his *Paradise Lost*, does exactly what he smiles at the devils for doing in the Second. He enters into an elaborate argument to justify the ways of God to man, on the ground of divine foreknowledge being compatible with human free-will. Apparently he does not entertain the slightest suspicion that here, too,

may be a wandering maze. And Omar Khayyám, though scornful of the schools, develops his own type of philosophy—an early form of Agnosticism, tempered by Pantheistic sentiment and accentuated by the spirit of revolt from the bondage of tradition ; an Agnosticism which finds its echo in very many modern minds besides FitzGerald's.

In fact, it is only those who are wholly absorbed in worldly or selfish pursuits, and quite indifferent to truth in the abstract, who can avoid reflection on the seemingly insoluble problems of philosophy ; or, if the thoughtful man does eschew certain of these problems, such as the ones relating to God and immortality, it is because he thinks that he has solved the prior problem of knowledge, so far as to be sure that nothing can be really known concerning those great hypotheses. But for thinkers at large the problem of knowledge still wears an unsettled aspect. No would-be solution of it commands general assent. Differences on this head divide the schools of modern philosophy even more than do the ontological speculations which lie beyond, and which are admissible or inadmissible precisely according to one's view of the nature and scope of knowledge.

What is knowledge? What are the principal things of which we have knowledge? In what ways do we come to know these things? What is the relation of knowledge to practical life? What are its relations to religious belief, to mysticism, to

poetical insight and æsthetic perception? These are fundamental questions. There is no thinking man who does not at times ponder them. There is no dogmatist whose dogmatism, no bigot whose bigotry, does not depend on his neglecting to ask these questions honestly of himself.

Although I hope, in the following pages, to afford some passing clues towards answering all these questions, it is to the first two that my inquiry is specially directed. Until the notion of knowledge, which is inseparable from the notion of reality as known, acquires some degree of scientific precision and elaboration, it is of little use to discuss the methods of attaining and of employing knowledge. We need an analysis of knowledge itself, appealing to common sense, or common human experience, of which the experience described as knowing is an ever-present factor; while the attempt to formulate knowledge logically is a factor of constant recurrence. There is here no question of forcing assent to a demonstration. The problem is to make explicit a system of ideas which is implied in all human consciousness, though seldom expressed, and never yet expressed with the required clearness and amplitude. Proofs can be adduced only for particular pieces of knowledge. There can be no proof apart from self-evidence, or realised fitness of description, of what knowledge itself is, or what is that universe of intuitively known things which stands in constant relation to it.

In reference to the task of philosophy, as he conceived it, Hume has quaintly remarked: "We must submit to this fatigue, in order to live at ease ever after; and must cultivate true metaphysics with some care in order to destroy the false and adulterated." If the only end of true metaphysics were to destroy the false and adulterated, its pursuit would be amply justified; yet I venture to think that philosophy has a somewhat more extended mission than either Hume, or his modern interpreter, Huxley, was aware of.

In the first place, philosophy is necessary to give a coherent unity to the various sciences. It is proverbial that many of our modern specialists and experts are in the position of persons who cannot see the wood for the trees. More appropriately might one say that they cannot see the tree for the branch on which each happens to be sitting, since it is the ideal of knowledge to become—what a tree is and what a wood is not—an organic unity. The simile reminds us that men who are shrewd investigators within the limits of their chosen departments are as apt, when straying beyond those limits, to indulge in pious platitudes and dogmatic assertions as if they were born tub-thumpers or pulpiteers. It is philosophy which sets the thinker at a removed point of view from which the whole outline of the tree of knowledge and the connections of the various branches with their parent stem become visible; while the necessity of scientific

caution is recognised as universally binding, whatever part or aspect of knowledge may be in question.

In the second place, philosophy is not confined to systematising knowledge and science on their subjective side. It is not mere formal logic, limiting inquiry to the relations of thoughts as such, nor is it mere psychology, concerned only with thoughts, sensations, and emotions, as occurring in the current of consciousness, or as related to the functioning of the brain. It aims to transcribe the whole system of nature—of reality—in so far as that is a legitimate object of inference from personal experience and from the intercommunication of human minds.

In the third place, philosophy is occupied with knowledge not only in its relation to the order of facts—of past and present actualities—but also in its relation to things unrealised or imperfectly realised, especially to the powers and possibilities of human action and organisation. It not only seeks to systematise the sciences, including sociology, in accordance with what is, but aims afterwards to systematise the arts of life, the social relations, and the elements of personal conduct, in accordance with what should be. That aim is, of course, ulterior to philosophy of knowledge, in the strict sense; yet philosophy of knowledge has to take into account the fundamental problems as to the nature of choosing, doing, and making, well or ill, which are constantly recurring facts of experience.

It has been admitted that hitherto philosophy has failed to attain the firm position of established science. There have always been rival schools of speculation; and thinkers who, like Hume and Kant, Comte and Huxley, have made special endeavours to define the limits of scientific knowledge and discourage idle theorising, have not been able to avoid creating rival theories of the more sceptical order. We are not, however, entitled to infer that this state of things must continue for ever. In every branch of human reflection which has at length become a recognised science there has been an inchoate stage of fanciful and contradictory doctrines, at which the possibility of the science itself might well be called in question. Yet in time the students of every genuine science come to agree among themselves as to the existence of a great body of appertaining facts and the validity of certain fundamental interpretations of those facts; notwithstanding that they may still entertain contradictory theories on outlying questions which demand fuller investigation. The same sort of basic agreement may yet be arrived at between the students of philosophy, and then philosophy, too, will assume the position of a recognised science.

Knowledge being quasi-organic, the philosophic analysis of knowledge may be appropriately regarded as concerned with the *anatomy of knowledge*. I shall venture to trace a parallel between

the philosophy of the past and the pre-natal state of the organism; also between the post-natal state and that of the philosophy to which all earnest thinkers aspire, and at the birth of which I have the ambition to assist.

In the growth of man, as in that of any one of the higher animals, there are two well-marked stages: first, the transformative development of the infant from a simple germ cell; second, the expansive development of the mature human being from the fully-formed infant. Naturalists tell us that during the earlier stage the fertilised germ cell becomes a group of cells, and from this vague and relatively structureless nucleus the various organs are slowly evolved, some appearing earlier and some later, until at length the embryo becomes a perfect organism, ready to assume an independent existence. It is here important to observe that the germ cell, though the ultimate origin, is in no sense an epitome of the child; while, on the other hand, the child is an almost exact epitome of the adult. Notwithstanding certain developments which have still to take place, the babe is a man or woman in miniature; practically every organ is present and occupies its natural place in relation to the other organs which go to make up the human anatomy.

I assume, then, that the growth of philosophy, or of human knowledge as a consciously and logically connected whole, is analogous to the growth of a

human being. The history of speculative philosophy, commencing with the vaguest and crudest surmises, and alternating with critical movements scarcely less crude, developes through a series of startling transformations. Now one aspect of truth assumes exaggerated importance, and now another; while many mythological elements appear, like those vestiges of lower forms of life which the human embryo displays. In short, embryonic philosophy presents such various shapes at different stages that sceptics are encouraged to make light of its vital unity, and regard it as a mere bundle of contradictions which can never come to a satisfactory birth. But all the while the tissues and organs of philosophy are undergoing harmonious development. The really valuable notions of outgrown systems are ready to be brought into line with one another. What have appeared to be contradictions are ripe to be revealed as complementary aspects of truth. It is becoming possible to trace an organic connection in the parts of knowledge which will not need to undergo further transformation. Organised knowledge may be but as a babe, yet its anatomy tends rapidly to perfect itself. This babe is perhaps destined to grow to dimensions which we cannot conceive; but none the less is it bound to grow along lines which are already familiar to us, and from which it cannot depart except by dissolution—by ceasing to be organised knowledge. To realise and systematise these

abiding features of knowledge has always been the object of constructive philosophic endeavour.

The foregoing analogy between philosophy and the organism admits of considerable extension. Just as the organism is built up of living units called cells, so knowledge has its all-pervading structure. The least item of knowledge involves a certain relation—a certain correspondence between subject-matter, or thought subjectively considered, and the object-matter, physical, mental, or psycho-physical, concerning which we think. In this correspondence lies the ultimate condition of knowing anything. We cannot reflect, and cannot intelligently observe, except from the objective-logical standpoint, where words are taken as symbols of something which, compared to the words themselves and the momentary notions they evoke, is relatively original or real, yet which must be known, if known at all in the scientific sense, by means of fitly-chosen words. Although, by an act of memory, we may reflect upon the current of our own experience, or conscious life, as a connected whole which is not bounded by the thought immediately directed to it, and although, by an act of inference, we may reflect upon things as forming a cosmos which is not bounded by our own experience, in either case we do reflect, and the only rational expression of our reflection is language logically employed. Only in the act of reflection can truth, or the true symbolisation of things,

consist ; only by this act can anything be so much as submitted for belief ; only as that potentiality which becomes actual when we reflect truly can knowledge itself have any existence. Of the cells in an organism some are healthy and fit to be retained, others unhealthy and fit only to be absorbed or rejected. So it is with the imperfect, but relatively perfectible, organism of knowledge. While the relation of some subject-matter to an apparent object-matter is the cell, as such, only those cells are healthy which present the relation of a truthful subject-matter to some real object-matter ; and the test of truth is logic applied to experience.

Now, for a further analogy. As in the human and cognate organisms there are distinct and relatively separable organs—limbs, brain, heart, stomach, and so forth—so in the known universe there are distinct object-matters, separable either actually (as plants and animals) or by mental abstraction (as physical contents and geometrical form), which give rise to distinct sciences. Hence the body of knowledge may be viewed as a system of the sciences.

But, besides the individual cells and the distinct organs, the organism has certain pervading structures—the vascular system of arteries and veins, and the nervous system, with its afferent and efferent branches. These structures permeate every organ, and are essential to its existence and

functioning. Similarly there are fundamental modes of reality and relations of things, apart from the relation of subject-matter to object-matter, which are presupposed in all the sciences alike; while there are others which are presupposed in important groups of sciences. The study of these pervading and uniting modes and relations forms a branch of philosophy distinct from, though complementary to, the study of the natural dividing-lines of the sciences.

A last analogy : we pass from the morphology of an organism to its vital functions. So may we do in the case of organised knowledge. Knowledge is the product of inquiry, observation, experiment, and deduction, and these are but different modes in which reason manifests itself. Reason is to knowledge as the energy of life to the living organism. Knowledge not interfused with the light of reason, not subjected to repeated tests, becomes formal and pedantic or mystical and extravagant. It loses its relation to known object-matter, and ceases eventually to be knowledge at all. Thus the first office of reason is to keep the body of knowledge healthy, by purging from it the fallacious assumptions and crude analyses which may have served in their time as steps to truth, but have become mere obstructions to those who mistake them for truths attained. The second office of reason is that to which philosophy of knowledge is especially addressed; to transform the

vague embryo of organised knowledge into a perfectly articulated, though, compared with what we hope it may be, an infantile, body. The third office is, by scientific investigation, to add to this body, whose ultimate stature and strength are beyond our present ability to conceive.

There is a fourth office of reason, the exercise of which in relation to the organism of knowledge may be compared to the purposive movements of the human organism. I refer to the scientific and philosophical applications of knowledge, which may be classed as (1) technological—concerned with the mechanical arts and industries of life ; (2) political—concerned with the art of government and the making and administering of laws ; (3) medical—concerned with the health of the individual organism ; and (4) ethical—concerned with the moral and intellectual integrity of the individual character, or, as it may be expressed, with spiritual health.

The fact that men have, from a remote period, applied such knowledge as they possessed in these various ways gives rise to a special department of knowledge—positive sociology, to use the latter word in the broadest sense—which treats of the history and present status of the arts, politics, medicine, and morals. But positive sociology differs from other positive sciences, in that its object-matter, consisting of past and current human practices, is continually and rapidly changing.

Inventive genius and social evolution are ever creating the human world anew. So far as the mechanical arts and medical practice are concerned, this transforming process can be traced to the advance of physical and physiological science, coupled with the reasoning powers of individuals who possess peculiar talents for applying theoretical knowledge to practical purposes. In politics and ethics the case is different. Here the influence of individuals—of rulers and statesmen in politics, and of religious and philosophic teachers (and, indirectly, of poets and novelists) in ethics—is sufficiently apparent; but there is no generally recognised scientific standard by which the value of political measures or ethical propaganda can be gauged. The politician is commonly judged by party standards; the moral teacher, by sectarian standards. In these supremely important spheres men simply obey—or profess to obey—the leaders who please them, and decry those who do not; while some despair of politics, on much the same ground as others despair of philosophy; and many eschew the search for ethical truth, either because they are quite self-satisfied, or because they are hopeless of improving themselves.

We are thus confronted with the problem: How can the philosophy of practice—political and ethical—be brought into line with applied science, or can it never be brought into line? Must it always remain as controversial and ineffectual a

subject as it now appears to be? Closely connected with this question are those concerning the relations of reason and conduct to religion. Does morality need to be enforced by faith in the supernatural? If not, is it purely an affair of enlightened self-interest tending to the common good, or does it properly draw its inspiration from a natural religion, envisaging the infinite universe or ideal humanity or the relation between the two?

However these questions may be answered, it is safe to assert that, given the possibility of applied sciences of politics and ethics, one important factor towards creating them must lie in the development of the corresponding positive sciences which treat of the human community as it is and of the psychology of the emotions and character. But there cannot be a positive science of the human community which does not take into account that supreme product of collective intellect and potent cause of social progress, science itself; and there cannot be a psychology of character which does not contemplate some intellectual equipment of knowledge, apart from which the best qualities of heart and will must fail to make a typical human being. Thus, if the applied sciences of politics and ethics presuppose positive sciences of society and character, these positive sciences themselves presuppose a philosophy which exhibits the organic unity of all science.

Language is the principal bond between the

individual and the community, and while the mythical and rhetorical uses of language are potent for combining men into sects and parties antagonistic to other sects and parties, its philosophic use, by defining terms, extending the chain of recognised meanings, and revealing the essential unity of human ideas, may in time combine the intellectual leaders of mankind and, through them, the race itself, irrespective of sect, party, or nationality. Thus a study which is often supposed to be abstruse and unpractical may yet prove to be the very fulcrum by means of which the power of enlightened human will is destined to effect a renovation of the world—an approach as near to Utopia as the facts of man's organism and environment permit of. And, in any case, the outlook of philosophy has this natural priority to the outlooks of abstract ethics and abstract politics—that it views impartially the individual, the community, and those facts of surrounding and pervading nature by which community and individual are alike governed.

PART I.

THE MEANINGS OF REALITY AND TRUTH

§ 1. *The Meanings of Object-matter and Subject-matter.*

ALLUSION has already been made to an all-pervading characteristic of knowledge—an element in the body of rational cognition which may be taken to correspond to the cell in the structure of the living organism. This element is the relation between subject-matter, or expressed thought, and some object-matter about which we think. To give these terms a still more definite value :—

An object-matter =¹ anything which is or may be intelligently named or logically conceived; = anything which it is possible to define or in any degree describe and take as a topic of discussion.

¹ Here and elsewhere I use the algebraical sign, = ("equals" or "equal") to signify logical equivalence, or complete identity. This should conduce to clearness in an essay consisting largely of analyses and definitions. It is not necessary to remind those who have any acquaintance with logic that the copula formed by "is" or "are," while implying some degree of identity between subject and predicate, does not necessarily or usually imply that these are simply different verbal expressions for the same thing or things. When, therefore, this strict identity is intended, the copula, =, may be employed with advantage.

A subject-matter = either a significant name or the notion which accompanies and gives significance to the name, or the definition which expresses the notion in brief, or any statement or set of statements whereby the notion is unfolded.

✓ A notion, as I understand it, = an idea attached to a name, or term. Notions are, therefore, to be distinguished from unexpressed ideas, such as may be held to be present in the consciousness of the lower animals, or in that of man when he perceives and acts intelligently, but without formulating his thought. They are also to be distinguished from ideas expressed otherwise than by phonetic language ; for instance, by purely hieroglyphic signs, gestures, play-acting, pictures, diagrams, statues, or music. They are to be distinguished from concepts (= conceptions) in so far as concepts may \ be supposed to occur to, or remain in, the mind, independently of names ; and also in so far as concepts are identified with general ideas, whereas notions include also singular ideas, such as attach to the names of individual persons and places, however these may be compounded of general elements. Notions are the ideas with which speakers and listeners, or writers and readers, have to do. They are the only ideas with which men in their speaking, listening, writing, or reading capacities can have to do.

In its non-technical employment, the term "subject-matter" has been the source of much ambiguity.

It no doubt refers to the matter, as apart from the mere logical form, of thought; but what do we mean by this matter? Do we mean the matter thought *about*, or the matter immediately involved in thinking? There is here a more important distinction than lies between the form and content of thought—namely, the distinction between cases of thinking, as such, and things which are not, at least not primarily or generally, cases of thinking at all. To limit “subject-matter” to the former sense may, by some, be considered arbitrary; but I must beg of the reader to accept my definition for the present, and to remember that, so far as my argument is concerned, subject-matter means the notions passing at any given time in the mind of this or that individual, concurrently with the flow of language, outwardly or inwardly expressed. In general we assume these notions to be counterparts of those which would pass in the same mind at any other time, and also of those which would pass in any other mind, if appealed to by the same language. Thus and thus only can we regard a given text or book as furnishing a definite subject-matter, common to divers readers. Limiting subject-matter to this sense, the term object-matter suggests itself as naturally antithetical—as applicable to matters referred to by particular thoughts, but lying beyond the particular thoughts themselves.

§ 2. *Philosophy as Objective Logic.*

Logic, as commonly understood—namely, as stating the laws of deduction, or consistent argument, = what I should term *subjective* logic. It is confined to investigating the internal relations of *subject-matter*, and the only criteria of truth which it offers are formulæ of the correct modes of proceeding from statements taken as true to other statements which are proved to be true by means of the accepted ones. When we inquire how our original premises are known to be true, or in what sense any statement can be said to be true, we forsake the province of subjective logic for that of another science, which is not usually regarded as logic at all. This science is, however, as I shall endeavour to show, naturally complementary to subjective logic, and therefore I venture to describe it as objective logic.

The distinction between subjective and objective logic is aptly suggested by the diverse relations implied by the synonymous words, “term” and “name.” A term is related to other terms, as the subject or predicate of various propositions. A name = a term ; not, however, as viewed in relation to other terms, but as viewed in relation to some object-matter named. Nothing whatever can be discussed without an at least implicit reference to this relation, and objective logic, which, in my opinion, is co-extensive with philosophy of know-

ledge, is distinguished by keeping this relation of names to things named always explicitly in view. Subjective logic must assume that any names employed are adequately representative of things named. Philosophy inquires *how* names represent, and *what* things can be thus represented. It compares the data of subjective logic with data which lie altogether beyond the sphere of names and notions, as such. These ulterior data consist, firstly, in sensations, emotions, and motives, accompanied by those rudimentary ideas which have not acquired logical expression ; all of which are object-matters of psychology. Secondly, they consist in number, time, space, bodies, and physical processes, mechanical, chemical, or physiological, all these being object-matters of the cosmological, biological, and technological sciences. In the third place, they consist in the facts of human nature and the institutions of human society, both of which involve the constant interplay of physical and mental factors, and which respectively form object-matters of the positive sciences of anthropology and sociology, and of the regulative sciences of ethics and politics.

A form of objective logic exists already as theory of induction ; the "phenomena" and "circumstances" referred to in J. S. Mill's canons of induction being object-matters in relation to the canons themselves, and all observed occurrences being object-matters in relation to the records which

scientific observers make of them. But induction, at least in Mill's sense, has to do purely with ascertaining the causal connection of things, whereas causation is only one (albeit the most practically important) of those relations which have to be considered from the objective-logical point of view. The first of these, in logical order, is that of subject-matter to object-matter; while there are others, prominently those of the general to the singular and the abstract to the concrete, which it is necessary to study carefully before any adequate conception of natural causation can be formed. Moreover, whatever may be the value of rules of induction, the truth of all particular inductions depends on the correct observation or experimentation of the scientific expert. That such observation or experimentation can be correct is a proposition in objective logic, indicating the psychology and physical adaptations of the observer, and usually, also, the nature and accuracy of certain physical instruments which he employs.

§ 3. "*Objective Logic*" versus "*Metaphysics*."

The science which seeks to determine the character of truth as apart from the simple consistency and cogency of subject-material argument, and which also seeks to systematise the qualities and relations of things over and above their physical parts and motions, is frequently called metaphysics. The present essay will be a contribution to

metaphysics in these senses. In practice, however, metaphysics has been rendered rationally disreputable by its ancient subservience, and generally accommodating attitude, to dogmatic theology. Not but what the work of modern metaphysicians has tended to rationalise theology; but, while running counter to the grosser forms of theological myth, it has almost always assumed an apologetic character. This has prejudiced the claims of metaphysics in the eyes of those many persons by whom the possibility of a genuine science of theology is doubted or denied.

If, in place of "metaphysics," we write, as I propose to do, "objective logic," there will be no suspicion of an ingrained bias to save the face of the theologians.

Most sciences are named *logies* (=logics), and objective logic is the science which covers, in salient outline, the ground of all other sciences, not omitting subjective logic itself, nor theology, if its claim to be a science is capable of substantiation.

§ 4. *The Ultra-universality of Object-matter.*

Object-matter stands, in objective logic, as the supreme genus of things. While formally universal, it is, in relation to the universe of reality, ultra-universal. This is owing, partly to the exuberance of poetic and mythopœic imagination, which separates and recombines the qualities, powers, and

relations of things otherwise than as they are distinguished and combined in nature, and partly to the deficiency of scientific imagination, with its correlative deficiency of defined language. Such deficiencies permit of the growth of an order of verbal ideas, referring to quasi-entities which are often tenaciously believed in, though they have not the *a priori* plausibility of mythical beings, and logical analysis alone suffices to make an end of them. Not all thinkers will agree as to the actual extent of mythological delusion and sophistical illusion; but probably all will agree that some supposed beings are mythical, and that some quasi-entities are mere products of confused thought. In both cases there are ostensible object-matters; but these object-matters are not real. Hence the whole hypothetical genus of object-matters contains the two species, real and unreal object-matters, to discriminate correctly between which is one of the chief aims of philosophy and scientific criticism. We cannot assert of anything whatever that it is not an object-matter in the general or hypothetical sense, though we may say that some object-matter is not known to exist, or may say of some other object-matter that it is knowably unreal, in the sense of being either a frankly unhistorical fiction or a something believed by certain people to exist, but which can be shown to be the product of a sophistical or mythopœic process of thought.

5. *The Universality of Real Object-matter.*

Real object-matters may be either concrete or abstract, and either singular or general. The fallacy of Platonism and mediæval Realism, much of which survives to the present day, does not consist in asserting the reality of the abstract and general as such, but in treating what is real only in the abstract and general modes as though it were real in the concrete and singular modes. For the rest, relations, as well as things related, are real object-matters; the processes of nature are as certainly real object-matters as the material objects in and between which they take place; and the natural process of human consciousness, with all which it involves, is as certainly real object-matter as the physiological process of life.

It is here important to observe that, although possibly all science may grow out of immediate states of consciousness (= experience) under the selective process of reason, implicit or explicit, yet we can have no scientific knowledge of these immediate states until they are viewed in mental perspective as object-matters. Each passing state is then seen to be categorically related to like states which have occurred to ourselves in the past, and which presumably occur to other people; while each is also seen to be contingently (whether accidentally or causally) related to the different states which immediately preceded or accompanied it in

the current of our own consciousness. States of consciousness, of course, include not only the broadly psychological states of sensation, perception, implicit inference, emotion, and motive, but also the specifically logical states—notions, judgments, and inferences, as expressed in discourse. These constitute what has already been described as subject-matter; so that, when we reflect upon them, subject-matter itself becomes object-matter.

§ 6. *The Natural Transcendence of Subject-matter by Object-matter.*

It is evident that object-matter cannot be technically defined, since it has no proximate genus and difference; yet the statement of its essential relation to thought, or subject-matter, serves the purpose of a definition. This has been given in § 1, but must now be considered more particularly.

Every subject-matter has an object-matter which appears to be either wholly or partially distinct from itself (the subject-matter) in one or other of the three respects of place, time, and kind; normally, in all three respects.

The above, which I take to be the first and most fundamental law of objective logic, may be illustrated as follows:—

Suppose a returned traveller giving a lecture in London on the customs and beliefs of certain tribes of Central Africa. Now, firstly, the subject-matter exists in London, in the form of propositions



appearing to the minds of the lecturer and his audience; while the object-matter exists in Africa. But even if the lecture were delivered in Central Africa to a gathering of natives, the place of its delivery would be merely one point in the area over which the beliefs and customs in question prevail. Therefore the object-matter is at least partially distinct in place from the subject-matter. Secondly, the subject-matter began to exist when the lecturer first threw his observations into logical form; but the object-matter—the native beliefs and customs—had previously existed for years, decades, or centuries. Therefore the object-matter is at least partially distinct in time from the subject-matter. Thirdly, as regards kind, the customs of the savages are as different from the utterances of the lecturer as bodily actions in general are different from simple expressions of thought. The *beliefs*, indeed, have the same general character as the judgments which the lecturer sets before his hearers. Both are cases of consciousness, of relative rationality, and of expressible conviction; but, within these limits, there are wide differences. The beliefs of the savage about Mumbo-Jumbo are quite unlike the beliefs of the civilised man about what the savage believes. Thus the object-matter of the lecture is at least partially distinct from the subject-matter in kind, as well as in place and time. Take any normal instance of clear and purposeful thinking, and there will be found to be

the same threefold distinction between the object-matter itself and our mental representation of it.

§ 7. *Sciences as Subject-matters having
Object-matters.*

The most extended subject-matters are the sciences. Each of these exists in very many minds, in very various places, and during a period of time which may stretch far into the past, and will stretch as far into the future as human intellect itself. Yet every genuine science has an object-matter of far wider extension and far deeper intensity than its own subject-matter. In other words, there is a set of facts, or of objects and facts, which the science is continually investigating, and from which its whole significance is derived, but which it never imports into itself except in a purely metaphorical sense.

To take a very obvious instance, the subject-matter of astronomy is only known to exist in the minds of a few of the more intellectual among earth-dwelling human beings ; but the whole earth is a mere atom in the stupendous object-matter of astronomy. If, however, we take the least obvious case of the distinction between the subject-material science and its object-matter, we shall still find that the distinction is there. In subjective logic, or logic as commonly understood, certain aspects of subject-matter form the whole object-matter in view ; yet the object-matter of subjective logic is

immensely more extended and diversified than its subject-matter. The subject-matter is expressed reasoning as contained in treatises of logic; the object-matter is expressed reasoning as contained in essays and works of any and every science, or as present in all cases in which men exercise their logical faculty.

§ 8. *The Logical Forms of Reality, Science, and Truth.*

Assuming that an object-matter has a real distinction from its subject-matter, while the subject-matter has a valid correspondence to its object-matter, we call the object-matter itself REAL and the subject-matter SCIENTIFIC; while the statement that the object-matter exists, with any other correct statement comprised in the subject-matter, is said to be TRUE.

Assuming that an object-matter has no real distinction from its subject-matter, but is wholly contained in the notion of itself, we call the object-matter UNREAL and the subject-matter UNSCIENTIFIC, and the statement that the object-matter exists is said to be UNTRUE.

The above may be termed the second and third laws of objective logic, being practically corollaries of the first law, given and explained in § 6.

There is here no attempt to offer an adequate criterion of truth and reality; which criterion can only be derived from analysing the psychological

sources, in conjunction with the logical processes of thought. But we cannot rationally seek a criterion of truth and reality without meaning something by the names in question, and it appears to me that the characteristic meaning of reality—its specific difference from the hypothetical genus of object-matter—lies in its transcendence of the mere notion whereby we signify it to ourselves; while the no less obvious meaning of truth is true signification, or the valid correspondence of subject-matter to object-material reality.

§ 9. *Truth as Symbolic Reference.*

It remains to inquire in what sense true or scientific subject-matter can be said to correspond to real object-matter, and, if the reader has followed my argument so far, he will be prepared to agree with me that the correspondence is not a substantial likeness, but a symbolic reference.

In the physical region of reality, one horse is substantially like another horse; but the notion of a horse, which can only be unfolded as a set of statements describing the equine species, has no substantial likeness to horses themselves.

In the sensuous region of reality, one sensation is substantially like another sensation of the same sort, and one emotion is substantially like another emotion of the same kind and degree; but the notion of a given sensation or given emotion is not substantially like the sensation or emotion

itself. The notion has lost the vividness of the original feeling, but it has gained in the clearer consciousness of the relations which the original feeling had to other contents of the current of consciousness, and of those relations which, if the feeling was complex, were contained within it.

Let us now turn to the subject-material region of reality—the region scanned, not only by subjective logic, but by philology, science of literature, and intellectual history ; all which sciences have subject-matter, in some form, as their proper object-matter. Here the subject-matter employed to investigate has evidently some substantial likeness to the subject-material object-matter investigated, since both are instances of expressed thought. Nevertheless, it is not in virtue of this likeness that any statement comprised in the subject-matter can be said to be true. If it were, we should be obliged to admit that the bare fact of making a statement in philology, science of literature, intellectual history, or subjective logic, was equivalent to making a true statement. Obviously this is not the case ; there is plenty of scope for error and confusion in these sciences, and here, as in the other departments of knowledge, it is only in the correct symbolic reference of the subject-matter to an object-matter clearly differentiated from itself that truth can lie. (Compare § 6—the beliefs of the savage contrasted with the beliefs of the lecturer about what the

savage believes ; also § 7—the object-matter of subjective logic.)

§ 10. *Identity and Distinction.*

While a name or notion may contain symbolic reference to reality, and, to that extent, may be described as scientific or truthful, it is only of propositions or judgments that we can predicate truth as such. A single proposition, as stated in perfectly clear terms (if not so stated, what appears to be a single proposition is not really so, but is analysable into two or more distinct propositions), must be either true or untrue. To prove or disprove it may not happen to be easy ; but, even though compelled to suspend judgment, we cannot possibly form or conceive of a judgment intermediate between the proposition itself and its logical negation. Contradictory statements admit of no compromises.

It is thus of the first importance to inquire in what sense the subject-material assertion embodied in a statement can contain symbolic reference to any object-material reality, and, to begin with, what is the nature of logical assertion.

Every proposition consists of three parts—namely, the two terms, subject and predicate, and the copula, which affirms or denies the predicate of the subject. The affirmative copula may always be represented by “is” or “are,” though it is frequently involved in the verb which forms or governs the predicate. Thus, in the statement, “Hares run

quickly," the copula is hidden; but it is easily restored to sight by employing some such sentence as "Hares are accustomed to run quickly," where "Hares" is the subject, "are" the copula, and "accustomed to run quickly" the predicate. The negative copula is generally represented by "is not" or "are not"; but the sign of negation may be prefixed to the subject, as in "Not all men are geniuses," "No men are omniscient."

By employing negative terms as predicates we may, if we please, regard the copula as universally affirmative. Thus we have:

	<i>Subject.</i>	<i>Copula.</i>	<i>Predicate.</i>
No men are omniscient } =	All men	are	non-omniscient.
Not all men are geniuses } =	Some men	are	non-geniuses.

This, however, appears to me to be an artificial simplification of the fact of assertion, which really only complicates matters. Ordinary terms are not negative ones, and, normally, the predicate is either affirmed or denied of the subject. In fact, we may formulate a fourth law of objective logic, as follows:—

Affirmation asserts the whole or partial IDENTITY of the predicate-signified object-matter with the subject-signified object-matter; while negation asserts the whole or partial DISTINCTION of the former from the latter.

The fact of distinction is every whit as objective

D

as that of identity. Distinction is the necessary concomitant of relation ; it is the negative, of which relation is the positive, aspect ; and identity itself is only conceivable as that in which divers relations, and, therefore, divers distinctions, find a common centre. The very meaning of reality lies, as I have shown, in the distinction of an object-matter from the subject-matter which ideally corresponds to it.

§ 11. *The Import of Logical Equations.*

Use has already been made of the sign $=$ to signify that, in certain cases, the subject and predicate of a statement refer to one and the same object-matter, the copula affirming that it is one and the same. Such a logical equation may be regarded as made up of two universal affirmative propositions—namely, $X = Y$ involves All X is Y and All Y is X . If, however, with Sir William Hamilton, we admit definite quantity in the predicate, $X = Y$ may be taken to be the single proposition, All X is all Y .

That $X = X$ (that England is England, or a tree a tree) is, of course, nothing but a meaningless repetition of words ; yet logical equations, possessing the form $X = Y$, have a profound importance for science, in that they enable us to recognise the same object-matter under different relations, when, otherwise, the existence of distinct things might be supposed. All logical equations are verbal in the sense that they give precisely the same meaning to

distinct verbal forms ; some, however, are simply verbal, while others possess the highest objective value.

The purely verbal equations are statements of simple synonymity, as "Erin = Ireland," "*Homme*, in French = man, in English," "*Bellis perennis* = the common daisy." In these cases it may be thought that the subject-matter asserts no relations of the object-matter ; yet, in fact, it does assert such relations, albeit they are accidental ones, so far as the nature of the object-matter is concerned. Thus the first of the examples amounts to an assertion that the country *called* by some people, or in some cases, Erin is identical with the country *called* by other people, or in other cases, Ireland ; the fact that we *name* a country, or any other object-matter, being in itself a certain relation which we adopt towards it.

Of logical equations which possess, or may possess, a strictly objective value, some are singular statements, such as : "The prisoner in the dock = the man who snatched my watch," "Your brother = my uncle," "Lord Bacon = the writer of the plays commonly attributed to Shakespeare ;" while others are general statements. That "An isosceles triangle = a triangle having two equal angles" is an instance of the latter class of statement, its proof being involved in the famous fifth proposition of Euclid. That "A term = a name" is another case in point.

General logical equations of this kind may be

termed *statements of modal distinction with substantial identity*, or, more briefly, *statements of modal polarity*. Two equal sides in a triangle inevitably involve the equality of the two opposite angles ; nevertheless, the mode or aspect of having sides is distinct from the mode or aspect of having angles. In the course of this treatise I shall have more to say concerning statements of modal polarity. Here I will simply take one instance having a direct bearing on logical investigation—namely, the statement that “An object regarded as uniting in itself the various attributes of a species = an object regarded as one among many instances of the species possessing those attributes.” In other words, “An object viewed in its logical intension = the same object viewed in its logical extension.”

Another very important class of logical equations (usually, but not necessarily, general) consists in analyses. An analysis is a statement which predicates several distinct components as together constituting a whole (individual or collective), or several distinct species as being together coextensive with a genus. In the latter case the analysis may be termed *extensive*, and we may take, as simple examples of the type, “Bodies are either organisms or inorganic bodies,” “Propositions are either true or erroneous,” “Triangles are either obtuse-angled, right-angled, or acute-angled.” Using the algebraical signs of equality and addition, we should render the above, “Bodies = organisms *plus* inorganic

bodies," "Propositions = true ones *plus* erroneous ones," "Triangles = obtuse-angled *plus* right-angled *plus* acute-angled triangles." Of those analyses which predicate certain components as together constituting a whole, some refer to parts, mathematically or physically considered, as "An hour = sixty minutes," "Great Britain = England *plus* Scotland *plus* Wales," "The human body = the head *plus* the trunk *plus* the limbs." Other such analyses, which possess a more directly logical value, refer, not primarily to parts, but to attributes, which, taken together, and, in the case of concrete objects, with the parts, constitute the whole *nature* of a thing. These may be termed *intensive* analyses.

Thus, "A body = its matter *plus* its form (and structure, if an aggregate) *plus* its internal forces (of cohesion, etc.) *plus* its external forces (of gravity, etc.)," "The form of a body = its configuration *plus* its magnitude," "The life of a man = the unconscious processes of his system *plus* the process of consciousness."

When we analyse a genus into distinct species, we naturally require to know what constitutes the difference, or at least the most characteristic difference, between any one species and the rest of its genus. Hence arises that very important type of logical equation, the definition, of which the following simple example may here suffice :—"A triangle (species) = a rectilineal figure (genus), having three

sides (difference)." Definitions proper are always general propositions; but it should be noted that there are singular statements, running parallel to definitions, which mark off certain object-matters as unique of their class—*e.g.*, "London = the largest city in the world."

J. S. Mill has maintained, with formal propriety, that definitions, as such, cannot be the premises of existential arguments. We may define imaginary beings, and, if this is not our intention, we are implying the statement that the thing, as defined, exists. Without this statement the definition cannot help us to prove any other real existence. This is true enough; but it may well be remarked that the assertion of existence or reality (that is, of the distinction of the object-matter from its correlative subject-matter) is of no practical value without some *mode* of existence be assigned, and definitions are of the utmost service in assigning definite modes of existence to the object-matters of thought. Useful, in greater or less degree, are all logical equations, having the general form of $X = Y$. It would appear to be impossible to concentrate our attention on any one object-matter without identifying it by means of different verbal symbols.

§ 12. *The Three Degrees of Distinction.*

If we represent the object-matter of a logical equation by a single circle bearing the two symbols, X and Y (*Fig. 1*), we may represent any degree

of distinction between two object-matters by the relation of two circles, X and Y, which do not wholly coincide with one another. We shall then perceive that there are three fundamental degrees of distinction.

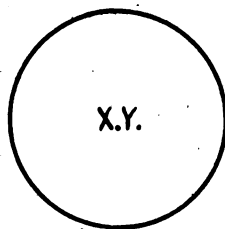


Fig. 1.

The first, or least, degree of distinction is that which accompanies the relation between some lesser object-matter and some greater object-matter

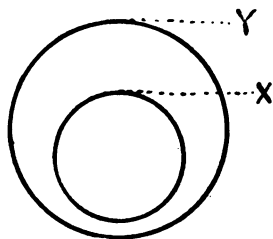


Fig. 2a.

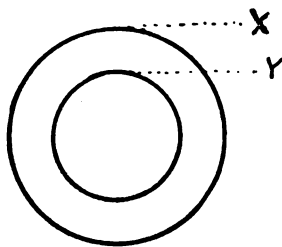


Fig. 2b.

wherein it is wholly included. X may be identical with a part of Y, leaving another part of Y which is not X, or *vice versa* (Figs. 2a and 2b).

The second, or medium, degree of distinction is that which lies between two object-matters having an over-

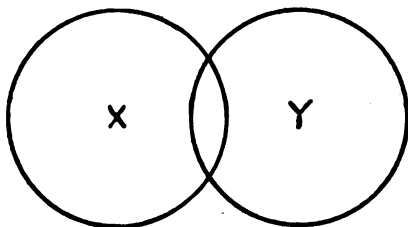


Fig. 3.

lapping relation to one another. Part of X is excluded from Y, and part of Y from X; but X and Y are in part identical (*Fig. 3*).

The third, or highest, degree of distinction is mutual exclusion—that which subsists between two object-matters having no degree of identity with one another. It is represented in Figures 2a and 3 by the distinction between X and the part of Y which is not X. It may, however, be more clearly represented by two circles which have no area in common (*Fig. 4*).

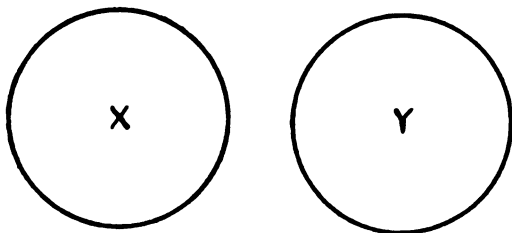


Fig. 4.

The Figures 2 to 4 are employed, in ordinary treatises of logic (according to Euler's method), to represent the relations of two classes or descriptions of object-matter, Figures 2a and 2b representing that of the genus to the species; but there are several other important *modes* in which the figures may be correctly taken to represent object-matters in relation. The diagrams themselves demonstrate that the three degrees of distinction, with the inclusive and overlapping relations, exist in superficial space.

§ 13. *The Four Formal Types of Statement.*

Statements, as reduced to their simplest form, for the purpose of ratiocination or syllogistic argument, are of four fundamental types :—

- (1) The Universal Affirmative.
- (2) The Particular Affirmative.
- (3) The Particular Negative.
- (4) The Universal Negative.

The Universal Affirmative takes usually one or other of the following shapes :—

All X's are Y (*e.g.*, All men are subject to sorrow) ;

All X's are Y's (*e.g.*, All trees are plants) ;

All X is Y (*e.g.*, All experience is worth attending to) ;

Every X is Y (or a Y) ;

An X (typical of its class, understood) is Y (or a Y) ;

X (unique of its kind) is Y (*e.g.*, The earth is spherical) ;

X (unique of its kind) is a Y (*e.g.*, Brutus is an honourable man).

The truth of the Universal Affirmative, "All X's are Y," *involves* the truth of the statements, "Some X's are Y" and "Some instances of Y are X's." It *precludes* the truth of the statements, "Not all X's are Y," "No X's are Y," "No instances of Y are X's." It *neither involves nor precludes* the truth of

the statements, "All instances of Y are X's," "Not all instances of Y are X's."

The Particular Affirmative has, as its principal forms :—

Some X's are Y (*e.g.*, Some plants are sensitive);

Some X's are Y's (*e.g.*, Some men are hypocrites);

Some X is Y;

Some one X at least is Y (or a Y).

If we say simply X's are Y, the proposition is called Indefinite, since we may intend the Universal, "All X's are Y"; but it is important to note that, in logical value, such a proposition is no more indefinite than is the Particular Affirmative itself; since this does not, by any means, preclude the Universal. To assert that some plants are sensitive is not to deny that all plants are sensitive. Recent investigations of botanists point to the fact that all plants are sensitive in certain ways.

The truth of the Particular Affirmative, "Some X's are Y," *involves* the truth of the converse statement, "Some instances of Y are X's." It *precludes* the truth of the statements, "No X's are Y," "No instances of Y are X's." It *neither involves nor precludes* the truth of the statements, "All X's are Y," "Not all X's are Y," "All instances of Y are X's," "Not all instances of Y are X's."

The Particular Negative assumes the following shapes :—

Not all X's are Y (*e.g.*, Not all soldiers are fearless);

Not all X's are Y's (*e.g.*, Not all animals are vertebrates);

Not every X is Y (or a Y);

Not all X is Y;

Some X's are not Y (or not Y's);

Some X is not Y;

Some one X at least is not Y (or not a Y).

The truth of the Particular Negative, "Not all X's are Y," does *not involve* the truth of any other statement. It *precludes* only the truth of the statement, "All X's are Y." It does *not preclude* the truth of either of the statements, "Some X's are Y," "Some instances of Y are X's," "All instances of Y are X's," "Not all instances of Y are X's," "No instances of Y are X's," "No X's are Y."

The Universal Negative may be rendered :—

No X's are Y (*e.g.*, No human characters are perfect);

No X's are Y's (*e.g.*, No crystals are organisms);

No X is Y (or a Y);

Not any X is Y (or a Y).

The truth of the Universal Negative, "No X's are Y," *involves* the truth of the converse, "No instances of Y are X's," and of the Particular Negatives, "Not all X's are Y," "Not all instances of Y are X's." It *precludes* the truth of the affirmative statements, "All X's are Y," "Some

X's are Y," "All instances of Y are X's," "Some instances of Y are X's."

Of the four formal types of proposition, the Universal Negative is the only one which states definitely the whole formal relation between the subject-named object-matter and the predicate-named object-matter. Its import is represented by Figure 4, and is evidently inconsistent with Figures 1, 2, and 3 (pp. 47 and 48). The Universal Affirmative, "All X is Y," is less definite as regards the relative extension of X and Y. It is consistent with Figures 1 and 2a; inconsistent with Figures 2b, 3, and 4. The Particular Affirmative, "Some X is Y," is consistent with Figures 1, 2a, 2b, and 3; inconsistent only with Figure 4. The Particular Negative, "Not all X is Y," is consistent with Figures 2b, 3, and 4; inconsistent with Figures 1 and 2a.

§ 14. *The Objective Import of Formal Statements.*

If X and Y are real object-matters, they must stand to one another in one of the relations represented in Figures 1, 2a, 2b, 3, and 4; and since all the formal statements except the Universal Negative are consistent with more than one of these figures, they all, so far, fall short of the definiteness of reality. In certain cases, as I shall presently show, the Universal Affirmative is sufficiently definite as regards the related object-matter; but this cannot be said of either Particular proposition. The

indefiniteness of the Particular statements has, however, a high subjective value in enabling us to take steps towards new knowledge. Knowledge usually grows by the recognition of previously hidden differences among object-matters with which we are familiar. We perceive at first that some X's have a belonging, Y, not shared by the majority of X's, or that some X's are deficient in a property, Z, which is usually associated with their class. When, however, these particular sets of X's come to be studied as sub-classes under names of their own, say V and W, what was a Particular proposition is replaced by a Universal. Instead of "Some X's are Y," we have "All V's are Y"; instead of "Not all X's are Z," we have "No W's are Z." As an instance of the first, or Affirmative, substitution, let us suppose that primitive men had come to name acorns before they learned to distinguish oaks from trees of other species. They would then make the Particular discovery that "Some trees grow from acorns"; but when they had studied the leaf and general character of these trees, and named them oaks, the above proposition would give place to the Universal, "All oaks grow from acorns." As an instance of the second, or Negative, substitution, there must have been a time, in the history of the English people, when adders and ringed snakes were undistinguished, as they still are by persons unfamiliar with their respective traits. Then the discovery that "Not all snakes met with in England

are venomous" might well lead to the more definite discovery that "No ringed snakes are venomous."

There are other cases in which a Particular statement may lead to the establishment of a Universal having the self-same subject. The observation that "Some plants are sensitive" may, as already hinted, be extended into a recognition that "All plants are sensitive." The now accepted Universal statement that "No women are capable of witchcraft" probably grew out of the earlier certainty that "Some women are not capable of witchcraft."

Thus, the whole value of Particular propositions consists in paving the way for new Universals; but what of that indefiniteness which lurks in the predicate of the Universal Affirmative? Is this necessarily a defect in the proposition considered as representative of object-material reality? I think not. The Universal Affirmative may, as we have seen, be expressed either as "All X's are Y," or as "All X's are Y's." In subjective logic, or for the purpose of deductive argument, these forms are interchangeable. It makes no difference in dialectics whether we say that all oranges are round, or that all oranges are round objects; yet the different implications of these statements is of importance in objective logic. When we say that all oranges are round, we are not really concerned with the relation between oranges as a species and the vague genus of objects which are round. We are really concerned with the

relation between the property of being round and the other properties which characterise the orange. We are *describing*, not *classifying*, oranges; the value of our statement is *intensive*, not *extensive*. The case may be illustrated by Figure 5, where the circle, X, represents an object typical of its class—say an orange—and the spaces bounded by two radii, Y^1 , Y^2 , Y^3 , represent different properties of that object. Thus Y^1 may mean the fact of being round; Y^2 , the fact of appearing yellow; Y^3 , the fact of being juicy. Now, any pair of radii may be produced beyond the circumference of X, indicating that the property, say, of roundness belongs to an indefinite number of other oranges and round objects. Nevertheless, the property of round-

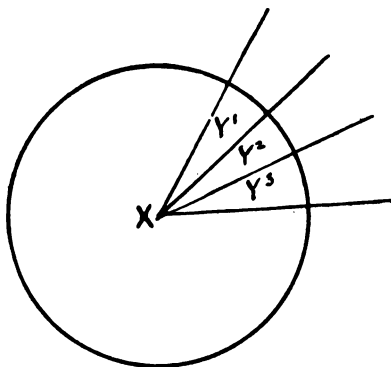


Fig. 5.

ness as centred in, or pertaining to, any typical orange does not belong to any object except itself. This fact is represented by the sector, or area enclosed by two radii, and a part of the circumference, of X. While, then, the orange is, in the mode of extension, included among round objects, roundness is, in the mode of intension, included among the

properties of the orange. In this sense, "All oranges are round" has a quite definite descriptive significance; but, if we say that "All oranges are fruit," we are classifying rather than describing oranges, and here the indefiniteness of the predicate does detract from the objective value of the statement. What we really mean can be formally expressed only by combining the Particular Negative with the Universal Affirmative, and saying, "All oranges are some, but not all, fruit," which may be more succinctly rendered, "Oranges are a species of fruit."

§ 15. *Object-matters, Singular and General.*

A statement is either singular or general, according as its subject is a singular or general term. A term, or name, is either singular or general, according as it refers to a singular or general object-matter.

A singular object-matter = something which has continuity in time, and which exists in some one place or continuous series of places or relatively contiguous set of places, being actually or conceivably located either by geographical or astronomical measurements = a single instance of any description.

A general object-matter = a kind = a plurality of instances of a given description, considered solely according to their common likeness and without reference to their distribution in time and

place, in both of which single instances may be ever so widely separated from one another.

In the definition of the singular, the reference to existence in *place* is preferable to any allusion to *space*, since neither the states of individual consciousness nor the institutions of human society can be said to possess the mode of spatial extension. Both, however, are necessarily located; the states of consciousness, with the individuals who have them; the institutions, with the nations among whom they obtain.

All proper names denote singular object-matters, which may also be denoted by common names, when accompanied by some mark of singularity, as "the earth," "that event," "the person in question," "the author of *Waverley*." Proper names denote without describing. No singular object-matter can be described except by the aid of one or more general terms. Nevertheless, these general terms may be so combined with singular ones as to indicate that the object-matter itself is singular. Thus, in "London is the largest city in the world," city is a general name, and so is largest, as applicable to divers cases of comparative size; but "the world" is singular, and thus the whole predicate becomes singular. Similarly, if we say that "Sir Walter Scott was the author of *Waverley*," "author" is general, but "author of *Waverley*" is singular.

In ordinary manuals of logic the distinction

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between the singular and the general is treated in a very cursory manner, since, for the purpose of argument, singular statements coincide with universal ones, the predicate applying to the subject considered as a whole. Thus, "Brutus is honourable" has the same argumentative force as "All men are mortal," while "Antony is not sincere" draws a complete distinction between Antony and sincerity, parallel to "No men are God-descended." It should, however, be remarked that singular statements having the forms "This X is Y," or "That X is not Y," may imply the particular assertions, "Some X at least is Y," "Some X at least is not Y." In objective logic, as contrasted with the formal science, this distinction between the singular and the general is of the utmost importance, and special care needs to be taken in drawing it correctly, since it is very apt to be disguised by the singular form which certain properly general names assume. Those to which I allude are the names of material substances and the names of attributes.

W. S. Jevons cites "the most precious of the metals" as a singular name, and asserts that metal is a general name, "because it may be applied indifferently to gold, silver, copper, etc." A little thought, however, must convince us that the name of any given metal is general, and that "metal" is general because it is applicable to all *instances* of all metals. There is, for instance, no single entity

corresponding to the name "gold." Gold exists only as the scattered instances of its occurrence in gold-bearing quartz and alluvial deposits, or as individual gold coins and other manufactured products. It connotes the chemical composition which is present in all instances of gold alike, and it should be understood to denote the instances themselves.

With a similar disregard of real instances, Jevons maintains that all abstract names are, as such, singular. While the adjective "red" is applicable to all red objects, "redness," he thinks, denotes only one thing. It "has one single meaning—the quality alone." But what is this *one* quality? Where does it reside? Nowhere that I can discover, except in the abstract name and notion of redness, and even there the singularity rests on pure convention. We agree to regard the name as one name, the notion as one notion, no matter how often, or in how many minds, the name and notion actually occur. If redness be considered psychologically, and taken to mean all actual sensations of redness, we cannot ignore the fact that these sensations are a dispersed multitude occurring to different people at different times and places. Even if they all possessed absolutely the same shade and intensity of colour (which, of course, they do not), they would still form a general, not a singular, object-matter. If, on the other hand, redness be considered physically, as a molecular property of certain objects which excite in us the sensation, it is

perfectly obvious that it belongs to those objects severally, not collectively. It is not one property of all the objects taken together, but a property of each object. It is, therefore, essentially plural, even supposing that it did not vary in kind and degree (as in fact it does) in the divers cases. Thus, no matter whether psychologically or physically viewed, redness is a general object-matter, and "redness" should therefore be regarded as a general name. The same is true of all abstract names.

I am aware that this controverts the opinion generally accepted by logicians, most of whom agree with Jevons at least in so far that they hold the majority of abstract names to be singular. Thus Mill regards the most specific abstract names, such as "equality," "squareness," and "milkwhiteness," as singular; while he admits "whiteness" to be general in respect of different shades of whiteness, and "colour" to be general in respect of whiteness, redness, and the other colours. Thus he argues with regard to "colour" precisely as Jevons argues with regard to "metal," and the answer of objective logic is precisely alike in the two cases. "Colour" is not a general name *because* it applies to the various species of colour; and "milkwhiteness," though indicating a "lowest species" of colour, is not singular. "Colour" is a general name because it applies to all *instances* in which the molecular structure of a material, affecting the vibrations of light, is such

as to excite colour-sensation in the observer; and "milkwhiteness" is a general name, because there are indefinitely numerous instances of milk and like-coloured substances. Thus abstract names imply *a definite degree of uniformity*, but do not in any case imply a real unity, between abstract instances.

Collective names are either singular or general, according as they refer to some one group of things, connected in time and place, or to a class of groups. Thus "the English nation," "the solar system," "the Tate collection," are singular; while nation, system, collection, group, etc., are general.

While the relation of a singular object-matter to any class in which it is included involves distinction in the first degree (see Fig. 2a, p. 47, where X is the object-matter and Y the class), the relation of all singular object-matter to all general object-matter is a case of modal polarity (see Fig. 1, where X may stand for the singular and Y for the general). There are not two sets of object-matters, but one set, which is viewed according to different relations; *generally*, according to categorical relations, or those of kind; *singularly*, according to contingent relations, or those of time and place. In the general mode the physical universe itself ranks as one instance of several classes. It is one object-matter, one real object-matter, one material continuum—enduring and extending indefinitely, yet,

in the facts of possessing duration, extension, and material constitution, being similar to any one of the finite objects which it contains. In the singular mode, on the other hand, the physical universe comprehends all general object-matters of which we possess or can possess knowledge; for, although we cannot theoretically limit the instances of a real class to any particular time or place, we must imagine each of them as existing somewhen in universal time and somewhere in universal space. It may also be remarked that the earth is a singular object-matter, in the whole extent and duration of which it is practically safe to say that a vast number of concrete-general object-matters are wholly contained. It is in the last degree unlikely that the numerous species of complex plants and animals evolved on the earth, or the numerous classes of complex objects produced by human invention and manual labour, have exact counterparts on any other planet or celestial body.

§ 16. *Object-matters, Concrete and Abstract.*

A concrete object-matter = an object = that which possesses, or is capable of possessing, an indefinite number of attributes (either qualities or relations with other objects as viewed from its own side), but which is not in itself an attribute of any other thing.¹

¹ "An object" is, as will be seen, the modern and scientific equivalent for "a substance," in the old logical and metaphysical terminology. Objects include "subjects," as persons.

An abstract object-matter = an attribute or defined set of attributes, as capable of being mentally isolated and examined, but as understood to be in reality absolutely inseparable from one or more objects to which it pertains.

An attribute = a quality or relation, as viewed either simply according to kind or according to the degree in which it is manifested.

A quality (form, action, state, property, or faculty) = that which belongs to an object in itself, though it is only cognisable by means of relation (both to the like quality in other objects and to human consciousness).

A relation = that which subsists between two object-matters (objects, or attributes, or object and attribute).

If the foregoing analysis be correct, there is a fundamental distinction between the concrete and the abstract which is usually ignored in formal logic, and is not at all accurately symbolised by the vague distinction which most logicians draw between concrete and abstract names. Let us consider what this last amounts to. Everyone admits that "rock" and "tree" are concrete names, and that "hardness" and "greenness" are abstract names. But what about "hard" and "green"? According to the formal logicians, "hard" and "green" are concrete names, because they are applicable to concrete objects; for instance, to the rock and the tree respectively. Thus, J. S. Mill

supposes that the distinction between "round" and "roundness" is of logical importance, constituting the first a concrete and the second an abstract name; while he asserts that the distinction between "round" and "a round object" is merely grammatical. To me the truth appears to be quite the reverse of this. Roundness is nothing if it be not the fact that certain objects are round; whereas the distinction between "round" and "a round object" may be taken to imply the different logical points of view of description and classification, alluded to in Section 14, in connection with a typical orange. It is not the latter distinction, but that between "round" and "roundness," which is purely grammatical. "To be round" and "to have roundness" mean exactly the same thing. In fact, adjectives, unless, like "corporeal" and "concrete," they have direct reference to the mode of concreteness, are logically abstract names. They are applicable to concrete objects, certainly; but only in virtue of particular abstract belongings. "Round," "swift," and "conscientious" are exactly like "roundness," "swiftness," and "conscientiousness," in signifying special attributes of round objects, swiftly-moving objects, and conscientious persons respectively. On the other hand, all that the abstract nouns can truly mean is neither more nor less than the adjectives mean—namely, the states of being round, of moving quickly, or of being conscientious. These

states are only real in the particular instances in which they may or might be observed, and the particular instances are, in all the three cases cited, bodies—corporeal particles or aggregates—though, in the case of being conscientious, it is not to “a body” as a mere body, but as the organic seat of intelligence and will, that the state belongs.

Formal logicians have confused the objective issues of logic, not only by treating adjectives as concrete names, but also by treating various essentially abstract substantives as concrete names. According to Dr. Keynes, “a concrete name is the name of anything which is regarded as possessing attributes—*i.e.*, as a *subject of attributes*.” Attributes themselves may be subjects of attributes, and he cites the case of “unpunctuality is irritating,” where “we ascribe the attribute of being irritating to unpunctuality, which is itself an attribute.” He admits that, on this showing, concrete and abstract names are not mutually exclusive; they overlap in the case of the names of attributes which have attributes. But is it not clear that a grammatical convention is here substituted for a logical distinction? Grammar allows us to say that “unpunctuality is irritating”; but no man ever swore or even frowned at “unpunctuality” for keeping him waiting. The obvious meaning is that unpunctual persons are irritating.

The above is perhaps an exceptionally weak illustration of the point for which Dr. Keynes

contends. It may, for instance, be truly said that movement, itself an attribute of the body which moves, has the two attributes of velocity and direction. To that extent movement is *quasi-concrete*. But, according to the definition given above, the mere possession of attributes does not make an object-matter really concrete, unless we are also assured that the object-matter "is not in itself an attribute of any other thing." I conclude, then, that all names of attributes are properly abstract unless, like "concreteness," "corporeality," and "substantiality," they expressly signify that which is not merely abstract. In these special cases the grammatically abstract name is logically concrete. "Concreteness" means the state of being a concrete object or objects, and this state is no mere attribute; it is the unity of all attributes in a concrete whole.

There are several kinds of abstract object-matter which are quasi-concrete; possessing secondary attributes of indefinite complexity, and thus affording distinct fields for investigation, from which the world of concrete, material objects may be ideally banished. Such are concrete notions, in which the indefinitely numerous co-existent attributes of real objects are indicated by an actual or potential sequence of predicates, indefinitely drawn out. Such are the complex subject-matters of the sciences and of literary works. Such are musical compositions, together with plays, pictures, and

sculptures, considered in their ideal aspect as works of art. Such, also, are the figures and relations of figures which geometry abstracts from the surface character, and relative positions, of bodies. Then there are energy and the modes of energy, such as heat, light, and electricity, investigated by the physicist; the current of consciousness and manifold potentiality of mind, treated of by the psychologist; the complex of character, inquired into by the students of human nature and of ethics; the constitution and institutions of society, dealt with by the sociologist.

In several of the above cases it is quite clear that the quasi-concrete object-matter is wholly dependent upon the existence of objects which are at once concrete and corporeal. A work of thought or art, be it literary, dramatic, musical, graphic, or plastic, must be embodied in reading, book, play, performance, picture, or sculpture; and, though it is capable of reproduction in divers ways and forms, it is never even conceived to exist except as it has some physical embodiment appealing to man, through his physical organs of sense—through eye or ear, or eye and ear employed together. Again, it is generally acknowledged, in spite of Kant, that the object-matter of pure geometry is a mere abstract from the universe of material bodies. It is also obvious that society and its institutions are nothing apart from the existence of the members of society—that is, of corporeal human beings. In physics,

logic, and psychology, however, the relation of the quasi-concrete to the really concrete is less clearly defined. Some physicists appear to conceive of energy as an entity more fundamental than bodies. Hegel and logicians of his school attribute the highest concreteness to "the idea" as such. Many psychologists and ethicists cling to the belief in a mind-entity not essentially dependent on the continued functioning of the individual brain, or compared with which the brain itself is phenomenal and relatively unreal.

As regards the contention of the matter-sceptical physicists, I would submit that all energy, as known to science, emanates from material objects—that nothing moves or grows which does not consist in one or more material particles or is not a material object, great or small, permanent or transitory, collective, individual, or forming a distinguishable part of some relative continuum. System, sun, planet, billow, river, pebble, animal, plant, micro-organism, molecule, atom, electron, ether-wave—these are the things in which movement and efficient causation reside. In all these cases a scientific conception of body unites the idea of form possessed to energy manifested; and to treat the mode of energy as a concrete reality is no whit more reasonable than to treat circles and triangles as concrete realities.

With reference to Hegelian logic, I need only remark that this and objective logic as sketched in

the foregoing sections are fundamentally incompatible. Hegel's system is based on the assumed identity of the idea with reality; while objective logic postulates as its first principle the real distinction of object-matter from its correlative subject-matter, and, hence, the essentially symbolic character of thought.

We come now to the case of the supposed mind-entity or spirit, which is thought to be not merely the system of mental faculties and states dependent on the structure and functioning of the brain—not, that is to say, a complex attribute of the human organism, but something somehow concrete or capable of entering into relations on its own account, and of leaving or surviving the body which harbours it. There are three views as to the nature of spirit; not of necessity mutually exclusive, but, for the most part, appealing to different orders of mind, if not to different stages of civilisation. The first is the spiritualistic view, a development or a survival of the primitive ghost-theory. The departed or absent spirit is supposed capable of making its presence known and producing physical effects *in this world*, and *without an organic body*; though it must be conceived to be or to possess some sort of “astral” or ethereal body, when affecting ponderable matter or the human organs of sense. The second theory of spirit is that of transmigration, or, as Malvolio tersely, if irreverently, defines it, “that the soul of our grandam might

happily inhabit a bird." The third theory, which is generally held by Jews, Christians, and Mohammedans, postulates "another world" or worlds as the destination of departed spirits; and, in so far as the crude notions of heaven beyond the firmament and hell beneath the earth and a future material resurrection are outgrown, the other world becomes another plane of existence, not subject to the conditions of time and space, as we know them, and, therefore, *ex hypothesi* unimaginable, but generally regarded as "higher" than the universe of which we have relative scientific knowledge. It is not my intention to attempt to rob believers in the independent reality of spirit of this last refuge. I should like to share it with them, if I honestly could. But even assuming that, for the purpose of existence on a higher plane or planes of being, consciousness, mind, and character are attributes of an immortal soul, the fact remains that, for the purpose of existence on this present plane, under the conditions of time and space, and, in particular, of the planet earth, and as we know them in ourselves and others, consciousness, mind, and character are attributes of the living organism. Unless there be any valid evidence of the existence of disembodied or transmigratory souls (which I cannot see that there is), we must admit that the earth-sojourning soul is abstract in relation to the concrete organism of man.

One thus arrives at the conclusion that, whether

or no there be other planes of spiritual existence, the only object-matters of the known world which are truly objects or concrete entities are material bodies or parts or systems. To these or to the processes taking place in and by and through them really belong the "forms" of geometry, the "energies" of physics, the "consciousness" and "mind" of psychology, the "character"¹ of ethics, the "creations" of art, the "institutions" and "constitutions" of sociology, the "notions" and "subject-matters" of logic and philosophy themselves.

There are three forms of concrete reality which may be termed individual, sub-individual, and super-individual respectively. The earth and a single human being are manifestly individual objects; while a stratum of the earth's crust and a limb of the body intact are sub-individual, being dependent parts of independent wholes; and, on the other hand, the solar system and a nation are super-individual, being composed of widely separated units which, in certain respects, act together as one thing. But while this threefold classification holds good of the more highly-evolved objects, there are many objects to which it cannot be applied without

¹ By consciousness I understand the current or series of conscious states or experiences of any individual; by mind, the complex of acquired memories, opinions, and habits of observing and reasoning, which frequently reappear in consciousness; by character, the complex of moral tendencies, or habits of emotional feeling and conscious physical action or inhibition of action, which also frequently reappear in consciousness and affect practical life.

reservation. For instance, that which is sub-individual under the conditions of evolution may become individual under the conditions of dissolution ; as a detached fragment of rock, a severed limb, organic particles excreted or freed in the process of decay. It is also highly questionable, in the case of molecules and of some of the simpler aggregates of matter, both inorganic and organic, whether we can draw, or where we should draw, dividing lines between the true individual, the mere part, and the system of individuals.

§ 17. *Material and Logical Components.*

A material component = either a distinguishable part of some individual body, or a separate member of some physical or social system.

A logical component = an attribute—quality, relation, or degree of quality or relationship.

That which clearly distinguishes a material concrete object from object-matters which are merely quasi-concrete is the possession of physical parts or members extended in space of three dimensions. The *fact of possessing* parts or members is, indeed, an attribute of the whole object which possesses them, being a case of inclusive relation, as symbolised in Figure 2 (p. 47). The parts or members, however, are not mere attributes, but are, in themselves, objects. They possess their own extension ; and they also possess, according to their degree of differentiation within the whole object,

many other attributes of their own. The simplest and minutest conceivable object, be it called atom or electron, or by any other name, must have parts mathematically distinguishable, although it may be incapable of physical sub-division. Some of its substance must be relatively central and some relatively external ; the latter terminating in some sort of surface or zone of separation from surrounding objects. But the atomistic philosophy which attempts to find an explanation of all things in substance, or parts, needs correction by the recognition of the equal reality of qualities and relations. Not only do the aggregates, inorganic and organic, of atoms manifest qualities and relations which no individual atom can possess, but the individual atom itself is a mere mathematical abstraction, unless we credit it with qualities and relations over and above its extension ; such as resistance, weight, and chemical affinities.

The relation between all the material components of an object taken together and all its attributes taken together is a case of modal polarity. The object, as composed of real parts or corporeal members, = the object as possessing real qualities and relations. In other words, physical science and objective logic address themselves to two different, but, so far as we know, equally fundamental, aspects of the same concrete reality.

If, as in Figure 5 (p. 55), we take the sectors of a circle to symbolise the attributes of an object, we

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may take a series of concentric zones, surrounding an inner circle, together with the inner circle itself, to represent the object's distinguishable parts or members. As all the zones, together with the inner circle, cover precisely the same area that is covered by all the sectors (see Figure 6), so do all the material components of a real object constitute the same reality that is constituted by the complete set of its attributes.

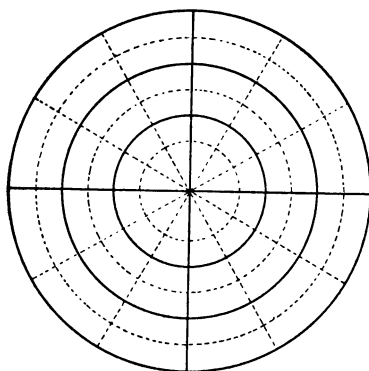


Fig. 6.

Of material components and attributes alike we have, and can have, only a relative knowledge ; but, just as it is possible to divide the *substance* of any finite object exhaustively into major components in which all possible minor

parts must be included, so is it possible to divide the *nature* of any finite object exhaustively into certain salient attributes under which its indefinitely numerous qualities and relations, many of which remain to be discovered, will necessarily fall. In Figure 6 we may multiply the zones indefinitely by describing new circles, as indicated by the dotted lines, and we may also multiply the sectors indefinitely by drawing new radii; but, just

as the new zones fall within the original two zones, or the originally innermost circle, so the new sectors fall within the original four quadrants.

Let the circle symbolise a human being; and its quadrants, (1) the external form which a sculptor or portrait-painter may imitate; (2) the practical life, or series of actions and passive intervals, the more important of which a biographer may record; (3) the physiological life, or totality of organic, sub-conscious processes; (4) the psychological life, or the current of consciousness, considered in conjunction with mind and character, as tendencies to the inception or reproduction of particular states of consciousness under particular conditions or stimuli. Much as we have yet to learn concerning human nature, it is safe to say that whatever we may learn will consist in an amplification of our knowledge of the above broad attributes; just as any advance in the science of human anatomy will consist in an amplification of the knowledge of organs already completely mapped out by the medical scientist.

§ 18. *The Modes of Extension and Intension.*

Allusion has already been made to this very important modal polarity, which must now be considered more particularly.

Extension = the number of instances, one or more, *denoted* by a name.

Intension = one or more attributes belonging to the instance or to all instances denoted by a name,

and which, therefore, the name either does or may connote.

Dr. Keynes¹ distinguishes three special meanings of "intension": (1) Conventional intension, or connotation as understood by J. S. Mill—this includes only those attributes which are implied in the definition of a general name, and, in the absence of any one of which, the name itself would be a sheer misnomer; (2) subjective intension, consisting in "those properties which, in the mind of any given individual, are associated with the name in such a way that they are normally called up in idea when the name is used"; (3) objective intension (= comprehension), or "the sum-total of properties actually possessed in common by every member of the class." Practically he also includes under the head of objective intension *the sum-total of properties actually possessed by any single object*, since he admits the intension of singular names. He does not, however, seem to recognise the peculiar importance of intension of this last description, to which I refer below.

As a special case under the head of subjective intension, Dr. Keynes mentions "the complete group of attributes known at any time to belong to the class." But here we must ask, how known and by whom? If the group of attributes known or supposed by some ill-instructed individual consti-

¹ In *Studies and Exercises in Formal Logic* (Macmillan), Part I., Chap. III.

tutes subjective intension, the group of attributes known to advanced scientific students of the object-matter under discussion comes as near to objective intension itself as the human mind has yet succeeded in approaching. It includes the most approved conventional intension, together with all those attributes which, though not logically implied in the meaning of the name, have been shown by scientific induction to be invariably present in the thing named. It seems to me that "subjective intension," as covering the notions which are attached to a name through casual and purely personal association of ideas, and as omitting, in the case of insufficiently educated persons, the greater part of the name's scientific intension, is an object-matter of psychology, which need hardly be regarded in a treatise of logic.

Taking the objective-logical point of view, I suggest the following amplification and rectification of Dr. Keynes's classification:—

(1) Absolute objective intension = the sum-total of parts or members and of qualities and relations pertaining to any real and singular object.

(2) Relative objective intension = the sum-total of qualities and relations pertaining alike to every instance of a given kind.

(3) Scientific intension = the whole group of attributes at present known to belong to an object-matter, whether to a singular thing or to every instance of a given kind.

(4) Conventional intension = the recognised definition of a class, with any attributes directly implied by such definition.

Absolute objective intension is, be it noted, the concrete totality of belongings, known and unknown, in a single object, *no matter whether the object be high or low in the scale of evolution*. Thus it must not be confused with any supposed maximum of intension or ideal completeness of nature. Comparatively few and insignificant as the attributes of a single speck of dust may be, the intension of a single speck of dust is just as absolute as that of a Shakespeare. When we consider absolute and relative intension together, we find that there are numerous general object-matters, such as the higher species of organisms, which have a far more complex and individuated type of intension than can possibly belong to certain singular object-matters; for instance, to a single cell, to say nothing about a single molecule, atom, or electron. Nevertheless, the intension of an individual cell is absolute, while that of a highly evolved species is only relative. To replace, in the latter case, the relative by the absolute, we must fix upon some one specimen of the species—some single plant or animal, with its individual features and its unique position and circumstances superadded to the attributes of its kind.

Absolute intension is absolute simply as being the whole nature and relationship of any singular

object-matter. As between any two or more compared object-matters it becomes relative. One object-matter may, as we have seen, belong to a species of great simplicity, while another belongs to a species of high complexity ; but, even among object-matters which belong to the same species, wide differences may be discovered when the complete natures of two instances are compared. We imply this when saying that one man " has more in him " than another.

§ 19. *The Inverse Relation of Extension to Intension.*

In logic¹ any general object-matter, or kind, which includes some other kind, is said to be a *genus*, of which the included kind is a *species*. Man is a genus in relation to the species, negro ; a species in relation to the genus, mammalia.

When we consider a series of classes, included one within the other, it becomes clear that the narrower or more specific—the less extended—a class may be, the greater is its relative intension ; or, to put the matter the other way about, the broader or more generic—the more extended—a class may be, the less is its relative intension. Man has all the attributes which do, and also numerous attributes which do not, belong to the

¹ In biology, genus and species have a much more definite application ; but that does not affect the present argument. .

group of mammalia as such ; a negro has all the attributes common to mankind, and also all the peculiarities of his own race ; while a particular tribe of negroes has additional peculiarities. When we pass from some lowest species to any one of the instances composing it, as from a tribe¹ to one of its tribesmen, we arrive at absolute intension. This is necessarily greater than the intension of the species to which the singular instance belongs ; although, as pointed out in the last section, it is not necessarily greater than the intension of some other species, which may happen to be far more complex than that to which the given instance belongs.

We may assume that, in certain lowest species, such as atoms of the same chemical substance, if not coins of the same value and issue, the individuals are exact counterparts of one another *as regards their qualities*. But, even in such cases, the individual has an individual intension exceeding that of the species. This consists in those local relations to surrounding objects which cannot be identical for any two individuals.

A relation similar to that which obtains between concrete genera and species obtains between those which are quasi-concrete and those which are evidently abstract.

¹ A tribe is one of those object-matters which may, for certain purposes, rank as logical species, although they are not purely general object-matter, but possess a certain collective and local unity.

"Thought" denotes more instances of thinking than are denoted by "reflection," since it covers all instances of imaginative, as well as all those of reflective, thought. "Reflection" connotes more than "thought," since it implies thought which, unlike some other thought, is concerned to arrive at true belief. "Reflection" denotes more than "science," since reflection is both scientific and unscientific. "Science" connotes more than "reflection," since it implies a strictly logical mode of reflection, and one which appeals systematically to experience.

"Colour" denotes more instances, but connotes a less definite character, than "red" or "redness"; "red" denotes more instances, but connotes a less definite character, than "blood-red."

At the opposite end of the scale to absolute intension, as attaching to unity of extension, we have absolute extension, accompanied by an ultimate minimum of intension. Of an object-matter, as such, we can predicate no qualities; its intension consists solely in its relation to the subject-matter of thought, as being that to which the subject-matter ideally corresponds. If the correspondence can be established, the object-matter is knowably real. If the fact of correspondence is doubtful, the object matter is hypothetical. If it can be shown that there is no correspondence in the case, the assumed object-matter having no existence apart from the subject-

matter, such object-matter is knowably unreal. Now, there is no law of thought, as such, by which the correspondence of subject-matter to object-matter can be established. The abstract laws of thought have to do exclusively with the relation of subject-matter to other subject-matter. It is therefore in the relation of thought to the not purely intellectual elements of experience, and to the objective world inferred from those elements, that we must look for a primary confirmation of the hypothesis that anything is real. *Apart from logical reference to experience which is not purely intellectual, the assertion of existence, or reality, is sheer dogma devoid of any possible verification.* A second mark of reality lies in singularity, or identification with what is singular. General object-matters are real only in so far as they are understood to consist of singular instances; the physical universe itself is, as we have seen, a singular object-matter. A third mark of reality lies in concreteness, or identification of the abstract with a content of the concrete. Thus the minimum intension of anything which we can possibly know to be real may be taken to consist in the three following alternatives. If we designate the experience which is not purely logical, together with the inferred objective world, as *primary*, regarding subject-matter and its internal relations as *secondary*, then a knowably real object-matter is:—

- (a) Either a primary object-matter or a secondary

object-matter related thereto, as thought is related to the other elements in the current of consciousness and to the functioning of the brain.

(b) Either a singular object-matter, or a kind consisting in singular instances.

(c) Either an object or objects, or an attribute or defined set of attributes of an object or objects, or a relation between two objects (viewed from both sides, and not as a mere attribute of either one object).

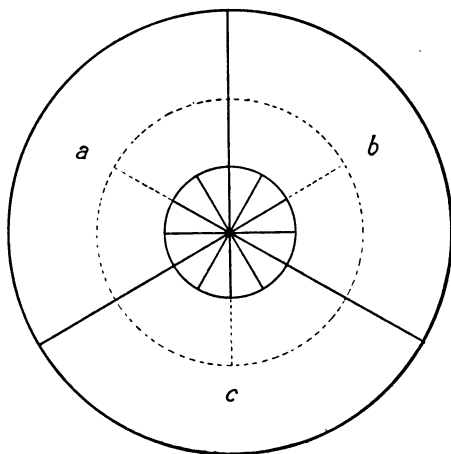


Fig. 7.

Let the outermost circle in Figure 7 represent the absolute extension of knowably real object-matter, and let it be divided into three sectors, *a*, *b*, and *c*, to signify the minimum intension of knowable reality above arrived at. Let the innermost circle represent a singular object-matter—say, an

individual human being named John Smith—and let the twelve sectors of this circle stand for the indefinite number of qualities and relations which constitute the absolute intension of John Smith. Between the innermost and outermost circles we may describe various intermediate circles to represent the many classes of object-matter which are generic in relation to John Smith and specific in relation to knowably real object-matter. Each of these circles will have fewer sectors than the innermost, and more sectors than the outermost, to represent the inverse relation of extension to relative intension. We may, for instance, have circles to symbolise the classes of Englishman, man, mammal, vertebrate, animal, organism, individual object, object (including super-individual and sub-individual as well as individual objects), physical object-matter (including movements and modes of energy as well as bodies). There are, however, many more intermediate classes which might be represented, especially in the biological zone. I leave the student to fill in the diagram according to his own judgment, having simply inserted a single dotted circle divided into six sectors to stand for the fact of relative intension and extension, as lying between absolute intension and absolute extension.

§ 20. *Reality Synthetically Viewed.*

Relative intension is real only in the sense that

it is mentally isolated from the absolute intension of the singular object-matters included in a class, *according to some real agreement in their nature*. Every instance of a class *has* absolute intension, although it is only relative intension which is connoted by the class-name. While the connotation of "animal" does not include that of vertebrate, or mammal, or man, the class of animals does include vertebrates with invertebrates, mammals with other vertebrates, men with other mammals, and, furthermore, it includes all individual animal organisms, with all the peculiarities of each. As consisting of individuals thus viewed in their absolute intension, the class of animals is a real class. As limited to its logical connotation, it is a mental device; not, however, an arbitrary mental device, but one which is grounded in the nature of things, even as are the abstract constructions of mathematics.

While a finite object, viewed in its absolute intension, is self-existent in a way that no mere attribute or relation or quasi-concrete object-matter can be, its every movement, and, in the case of an aggregate object, its very existence, is strictly dependent upon the influence of other objects. If the object be an aggregate, it is dependent on other objects: (1) As antecedent causes of its integration; (2) as integrated elements of its substance; (3) as co-existent conditioning realities, which are necessary to its preservation, as are the:

sun, the earth, and the atmosphere to that of a human being. The relations of an object to other objects which condition it are, in fact, invariable elements of its absolute intension—inseparable concomitants of its own qualities.

Taking into simultaneous account the relations of the general to the singular, of the abstract to the concrete, and of an object's absolute intension to its antecedent and environing conditions, we may formulate the four following statements as the fifth, sixth, seventh, and eighth laws of objective logic :—

The reality of a general object-matter (= a kind) consists wholly in the reality of the singular instances which are included in its extension.

The reality of an abstract object-matter (= an attribute or relation or defined set of attributes or relations¹) depends wholly upon the reality of

¹ In defining the abstract (p. 63) I classified relations as attributes, which, in fact, they are; yet they may also be legitimately distinguished from simple attributes, in that every relation involves the respective attributes of two object-matters. Relations viewed from one or other side, as centred in this or that object-matter, may be termed *concentric*, while the relation viewed as a balanced whole is *bicentric*. In the case of those bicentric relations which are known as *reciprocal* (mutual exclusion, overlapping relation, likeness, co-existence, proximity, etc.), the two concentric relations are similar. There are other cases, however, in which the two concentric relations are dissimilar: take the relations of object-matter to subject-matter, sensation to thought, physical stimulus to sensation, whole to part, genus to species, object to attribute, that which precedes to that which succeeds (both in time and in processions of co-existent object in space), cause to effect, parent to offspring, etc. Bicentric relations, such as these, may be termed *differential*, in antithesis to the *reciprocal* ones.

the objects by or between which it is manifested.

The reality of an object consists in its absolute intension.

The reality or absolute intension of any finite object depends upon its relations to all co-existent objects which condition its continued existence, and also on its relation to all objects which, in the past, have been instrumental either in bringing it into existence or (supposing it to be an ultimate atomic body) in determining its movements and present position.

These four laws may be embraced in a fifth and more comprehensive law, which will rank as the ninth law of objective logic:—

The total reality relatively known and progressively knowable = the time-extended universe of singular objects which either have existed, do exist, or will exist, every object being understood to possess an absolute intension, which includes its whole relationship to other objects.

§ 21. *The Correlation of Substance and Nature.*

If the foregoing conclusions be valid, we cannot identify reality, as such, with any one substance supposed to underlie the diversity of real objects. It is a great achievement of modern science to have established the indestructibility of matter and the conservation of energy. Yet it is not the permanency of matter and energy, but the fact that matter exists in, and energy produces, numberless

particular forms, which makes the real universe what it is. Permanency is continuity of reality ; it is not reality, as such. The most ephemeral of insects, or a bubble which bursts almost as soon as it is formed, has, while it lasts, as much reality as an ultimate and indestructible atom can have, or as can be had by that one substance which Haeckel supposes to be the basis and cause of all things, or as could be had by eternal Deity. Men and the various objects by which human life is conditioned have absolute reality, with varying degrees of permanency. The "oldest inhabitant," the longest enduring race, the steadfast mountain, the hoary earth, the mighty sun, the most stupendous star which burns remotely in the constellated heavens, is but a bubble on the river of infinite time. Nevertheless, it is through the relatively transitory forms of the celestial bodies, together with the minor and much more transitory forms evolved upon the earth's surface, that all efficient causation of which we have any practical knowledge takes place. It is not substance, as substance, but the radiant substance of the sun, which visits the earth with warmth and light, and the still subtler influences inferred by chemistry and physics. It is not substance, as substance, but the compact and clear substance of some crystal, which polarises a ray of light. It is not substance, as substance, but a very specific compound of carbon, which, in the form of the living cell, germinates and evolves into an

organism of this or that species. It is not substance, as substance, but an intricate process taking place in the complex brain of living and waking man, which appears as thought and thought-enlightened will, and subdues the brute forces of earth, sea, atmosphere, and ether, of chemical product, plant, and animal, and of the predatory animal in man himself, to the uses of true humanity. Everything which appears as an aggregate object, no matter how transient it may be, is a solid link in the chain of efficient causes, whether or no its effect be important from the point of view of human well-being. Of atoms or of ether, apart from finite aggregate objects, we have not, and cannot in the nature of the case have, any direct knowledge ; and while the speculation which strives to trace the evolution of natural objects, in their countless multitude and rich variety, from one primitive substance, is interesting in itself and, to some extent, indicated by scientific analogies, it must not blind us to the fact that the aggregate objects themselves are the things with which we are actually brought into contact, and which are fully as real, though nothing so permanent, as the substance which integrates into and disintegrates from their finite forms ; disintegrating only to make part of some new aggregate, no matter how indefinite in character.

If the whole formal aspect of things, embracing relations, qualities, and differentiated bodies or

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parts, be signified by the name "Nature," and if we assume with Haeckel that ether and the seventy and more "elements" of ponderable matter are all different conditions of one Substance, and that physical energies, life, and mind are different manifestations of one energy inherent in this Substance, then we must regard Substance and Nature as the ultimate modal polarity of things. Nature, apart from Substance, is a mere abstraction. Substance, apart from Nature, is the negation of all assignable attributes except indefinite extension, indefinite duration, and homogeneity of contents.

Real substance is Protean, assuming endless shapes in succession, and numberless shapes in co-existence ; but if we cannot confine our Proteus to this or that shape, still less can we discover him as a formless essence, when the basis of our own existence and experience is a formed and diversified cosmos. This, of course, does not dispose of the hypothesis that Nature has arisen by evolution from an undifferentiated Substance ; but if we adopt that hypothesis we must assume a potentiality, on the part of the original substance, to give rise to the countless multitude and endless variety of natural forms ; and if substance were originally an infinite homogeneous continuum—as, by the hypothesis, it must have been—we are left in wonder as to what efficient cause could set the process of evolution going, or produce a condensation of ether at certain points of space rather than

at other points. It would thus seem to be more in accordance with the principle of natural uniformity to assume that Nature, as well as Substance, is eternally actual, and, as a whole, unevolved ; that there is not, and never has been, any absolute homogeneity or undifferentiated unity of Substance ; but that while Substance, under certain conditions prevailing in certain parts of the universe, is reduced to a state of relative homogeneity, it attains, under other conditions prevailing in other parts of the universe, to all the complexity of highly evolved forms.

On this view, Substance and Nature are complementary modes of reality. Nature is the actuality of Substance ; Substance the potentiality of Nature. No deity, no virtue, no reality, resides in Substance which does not reside in Nature, or resides in Nature without residing in Substance. If Substance contains the creative energy of the universe, Nature contains every possible form in which that energy can find a temporary lodgment ; and, though the whole of Substance must be regarded as superior to any of its particular forms, it cannot be regarded as superior to the totality of forms in which it resides, and through the agency of which its energy is transmitted.

I therefore think that the Material Monism of modern scientific speculation will have to give place to what may be termed a Modal Dualism. This will not deny the hypothetical unity of

Substance (as to which it is not for the philosopher or biologist, but for the chemist and physicist, to say the last word), but it will assert the co-reality of Nature with Substance. It will thus rehabilitate, in the light of modern knowledge, Aristotle's conception of the actual and formal as the natural complement to the material and potential.

§ 22. *The Natural Transcendence of Knowledge by Reality.*

I have discussed, in Sections 6 to 9, the natural transcendence of subject-matter by object-matter; finding the first mark of reality to consist in the real distinction of an object-matter from its correlative subject-matter. In Section 20 it was pointed out that this mark of reality could not be known to characterise anything, unless accompanied by certain other marks which were inferred to be: (*a*) primary reality or relation to primary reality; (*b*) singularity or identity with the singular; (*c*) concreteness or identity with some content of the concrete.

In each of these three respects, which constitute reality in its minimum intension, does reality necessarily transcend knowledge.

(*a*) Primary reality includes the current of sensations and emotions, together with such ideas and connections of ideas as may arise instinctively and apart from deliberate reflection, and also together with bodily actions and the physical world

in which they take place. Secondary reality is identical with subject-matter, or thought in its logical expression ; beyond which rational knowledge cannot actually extend, though it can and does symbolise the things of the primary sphere. No doubt the process of thought is caused, as is the process of primary reality ; but the secondary process is complicated by the fact of reason, which demands that, when we reflect, our thoughts shall appear as premises leading logically to conclusions. Premises, then, have a relation to conclusions which is at least analogous to that of cause to effect ; but, whereas primary causes operate inevitably, the operation of these secondary quasi-causes is beset with the utmost uncertainty. Conclusions which are *logically* inevitable are often *actually* avoided by fallacious inference, while other conclusions are drawn fallaciously from premises which do not warrant them. The premises for conclusions which reasoning men wish to draw have frequently to be carefully sought after. Dogmatists commit themselves to statements, which could only be valid if logically deduced, without troubling about premises at all. Science is so far comparable to dogmatism that it must proceed from fundamental axioms which are undeduced. And not only may we form judgments without deducing them, but we may dwell long upon names and the notions they evoke without so much as forming any distinct judgment. This is a phenomenon which I

frequently observe in my own intellectual experience, and every writer must be aware of it when he seeks an appropriate title for his book.¹ Lastly, those conclusions which lie potentially in premises admitted by all men, or by all students of a given science, are not drawn until some philosophic or scientific genius arises to make a new synthesis of truth, or, as we say metaphorically, to open men's eyes. Thus the modal antithesis between logical thought and primary reality is probably the profoundest distinction in all nature. In thinking we are not, at least not obviously, carried along by the current of things, but acquire a certain aloofness from, and ideal superiority to, everything which can possibly become object-matter to our reflection. This aloofness, although it may lead in the end to rational conviction and conduct, is always associated with intellectual questioning, and frequently with indecision of character. It is often true that—

“ The native hue of resolution
Is sicklied o'er with the pale cast of thought,
And enterprises of great pith and moment
With this regard their currents turn awry,
And lose the name of action.”

But, as against Hamlet's famous cogitation, it may be said with equal truth that “enterprises of great

¹ In this connection it may be worth noting that the distinction between object-matter and subject-matter can always be observed in the titles of books. For instance, *Sun, Moon, and Stars* and *The Evolution of Man* are object-material titles; while *The Story of the Heavens* and *The History of Human Evolution* are subject-material titles.

pith and moment" are not the automatic happenings of sub-rational nature. They themselves really originate in "the pale cast of thought," which at first suggests their possibility, and gradually gathers strength and clearness till some deliberate and practicable design is formed and acted upon. Hence the secondary reality of reason—of reflection, inquiry, hypothesis which may lead to knowledge, plan of action which may lead to action itself—is of supreme human value. Reason is the true Logos, born from the union of man's intelligence with the art of language; interpreting for us the cosmic All; mediating between its energies and our needs; teaching the uses of things which would otherwise be unuseable, the wonder and beauty of things which would otherwise pass unnoticed. In short, reason is the thing of primary practical importance; yet it always remains secondary as regards its origin and place in nature.

We may note, in this connection, the words which Goethe puts into the mouth of Faust, at a critical moment of his career; words which appear to have such a disturbing effect on Mephistopheles in his first disguise as a stray poodle¹:—

"'Tis writ, 'In the beginning was the Word.'
I pause, perplexed. Who now will help afford?

¹ I quote from Anna Swanwick's translation (Bohn's Standard Library), p. 41; but have taken liberties with the exclamation marks, and have ventured to honour the Spirit with a capital.

I cannot the mere Word so highly prize ;
I must translate it otherwise,
If by the Spirit guided as I read.
'In the beginning was the Sense.' Take heed !
The import of this primal sentence weigh,
Lest thy too hasty pen be led astray.
Is force creative then of Sense the dower ?
'In the beginning was the Power.'
Thus should it stand ; yet, while the line I trace,
A something warns me once more to efface.
The Spirit aids ! From anxious scruples freed,
I write, 'In the beginning was the Deed.'"

According to the theory of evolution, the Word, or reason, understood to include the Sense, or subjective meaning, has actually sprung from the Deed, if we take that to symbolise the primary process of nature. It is matter of common experience that this Word is continually modifying the Deed within the narrow circumference of the human world ; but it remains the fact that the Deed—the causal reality—altogether transcends the Word—the ideality which it includes as its finest product.

(*b*) When we consider reality with reference to the extension of its singular instances, we find that reality transcends knowledge in the three respects of number, time, and space.

Theoretically, there can be no limit to the number of instances included in a class. There may be actual limits, in the case of certain complex classes, such as the higher terrestrial organisms, and the objects produced and reproduced by human handicraft. But even in these cases the actual numbers transcend knowledge in the sense of being wholly

unascertainable; while, as regards the colossal bodies which people space, and the molecules or atoms of a given chemical substance, it is an open and apparently insoluble question whether they transcend knowledge, merely as being incalculably numerous, or as being infinite in number.

The same is true of the duration of time, past and future, and of the whole extent of space. No matter whether we characterise these mysterious facts as infinite, or content ourselves with reflecting that they stretch indefinitely beyond any limits which we are able to assign, it is certain that they do transcend knowledge.

Moreover, the space filled by the smallest object and the time occupied by the most momentary event are theoretically divisible to infinity. Fractions can be divided as continuously as whole numbers can be multiplied. We can no more gauge reality in its mode of minuteness than in its mode of immensity.

(c) While the singular transcends knowledge as regards extension—the actual extent of time and space, the logical extension of object-matters in classes, and the mathematical divisibility of singular object-matters (each mathematical part being a quasi-singular object-matter)—the concrete transcends knowledge as regards intension.

This includes (1) the intension of ether, which, as possessing real and causal relations to the ponderable bodies floating within its immensity, must rank as a



concrete object ; (2) the intension of the ultimate particles of ponderable matter ; (3) the intension of finite aggregate objects, sub-individual, individual, and super-individual.

In the case of these aggregate objects, intension includes all interconnections of the material components, as well as the qualities and relations which are manifested as a result of such interconnections, and the relations to environing objects, which condition or modify the internal relations.

To know the whole intension of any finite aggregate would involve a complete knowledge of the causes which maintain its equilibrium, of those which have produced it, and of those which will unmake it, and re-combine its elements in new, and possibly higher, aggregates. Tennyson expresses this in the verse:—

“ Flower in the crannied wall,
I pluck you out of the crannies,
I hold you here, root and all, in my hand,
Little flower—but *if* I could understand
What you are, root and all, and all in all,
I should know what God and man is.”

If we include, in the intension of things, their whole potentiality, the intension of atoms would appear to transcend knowledge as signally as does that of aggregates. What Tennyson says of the flower might be said with almost equal truth of an atom of carbon ; since a full knowledge of its properties and relations would involve a full knowledge of all the organic structures and functions of which

it may come to form an essential ingredient, as also of its relations to the other inorganic elements, and to the whole energising reality which appears in the process and order of nature.

Thus the linked realities of substance and nature surpass knowledge (a) as the Deed—the cosmic process—surpasses the Word—the process of reflection, (b) as the extent of ether and the number of objects and movements distributed in space and time surpass mathematical computation, (c) as the absolute intension—the complete modality and relatedness of things—surpasses logical description. Many persons seem unable to realise this transcendence of knowledge by the real universe, without a sense of being hopelessly baffled and crushed by the All which they cannot comprehend. There is no rational necessity to feel this. Such a state of mind appears to me to be due to the recoil of the intellect from rashly ambitious attempts to enlarge the boundaries of knowledge—often from mistaken attempts to find human meanings in reality which, whether conscious or not, is certainly not consciousness in the way of human feeling or thought. While thus, to the baffled metaphysician turned sceptic, nature seems to oppose knowledge with impenetrable and insurmountable walls, to the lover of science she presents nothing but alluring vistas of possible knowledge stretching on all sides from that extensive clearing in the dense forest of

myth and ignorance which science has already made.

§ 23. *The Noumenal Aspect of Reality.*

In the writings of those characteristically modern thinkers who aim to trace all knowledge to its source in experience, and to justify natural science by exhibiting its inductive grounds (aims which I heartily approve), one frequently meets with the assertion that our knowledge is limited to phenomena. *If* phenomena include, together with the immediate appearances of consciousness, those objects which are inferentially perceived by means of sensation, and those which are inferred to exist in accordance with some data of sense, I agree that our knowledge is thus limited. But I cannot accept the above definition, or, rather, lack of definition, of the term "phenomenon" as satisfactory. It involves an ambiguity which has always tended to stultify Positivist and Agnostic methods of thinking, and has afforded grounds of just criticism to the Transcendentalist. Note how Huxley uses the term:—

If we analyse the proposition that all mental phenomena are the effects or products of material phenomena, all that it means amounts to this: that whenever those states of consciousness which we call sensation, or emotion, or thought, come into existence, complete investigation will show good reason for the belief that they are preceded by those other phenomena of consciousness to which we give the names of matter and motion.¹

¹ Huxley's *Hume*, chap. iii. (p. 95, in Eversley edition).

Huxley thus implies that matter and motion are just as much phenomena of consciousness as are sensation, emotion, and thought. But are they? If phenomenon signifies an immediate appearance, or experience—that of which we are subjectively sure, though we may err in classifying it, and are still more likely to err in attempting to explain it—the only true phenomena are states of consciousness in their momentary occurrence; felt sensations, felt emotions, and thoughts considered, so far as it is possible to consider them, without reference to their object-matters. Even such states of consciousness cease to be purely phenomenal the moment we name and classify them; the feeling as felt is no longer itself when compared in reflection with other like feelings. *It* was a singular occurrence, but the idea of it is one inseparable link in the chain of a general idea. Yet it is only as we form general ideas of feelings that we can know them with any degree of intelligence; and how can we have knowledge at all without some degree of intelligence? One may thus be tempted to pass from the dictum that knowledge is confined to phenomena to the paradox that phenomena, as such, are wholly unknowable. In fact, this would be the logical inference, if knowledge implied identity of subject-matter with object-matter. Since, however, it is of the essence of thought to symbolise object-matter distinct from itself, we may take it that phenomena (by which term I shall con-

tinue to understand immediate states of consciousness) come, in becoming object-matters of thought, to be known in the proper sense of the verb *to know*. They are also known with the highest relative certainty, since the acts of memory and generalisation, by which they are known, follow immediately on their occurrence.

If the above view of what constitutes a phenomenon be correct, Huxley is mistaken in classing matter and motion as "phenomena of consciousness." The least act of outward-pointing perception connects the idea of an object or objective movement with the immediate sensation which is supposed to be derived from such object or movement. When we see or think we see a tree in the distance, we recognise that it is a tree, with a trunk which could be clasped or climbed, with roots which might be exposed, with bark and sap, and numberless twigs and leaves which are not simultaneously visible. Thus we are not in the presence of a mere phenomenon, but of a natural noumenon; an object of the understanding which is superficially symbolised by its immediate visual appearance, but much more accurately symbolised by the notion which we have of it. The only phenomenon in the case is the visual picture of the tree presented to consciousness. All which constitutes the tree a real tree constitutes it also an object of reason rather than simply an object of sensation. It must be admitted that, as an

object of reason, it (the particular tree supposed) is known to exist with a less degree of certainty than the visual appearance. It may be an illusion—a mirage of the desert, a cunning instance of the scene-painter's art (such as adds imaginary distances of landscape to the suburban limits of the Earl's Court Exhibition in London), or the creation of a delirious brain. There is, however, an immense probability in favour of its being a real tree, and, if it be, we can verify our observation by approaching it, walking round it, and actually touching, and experimenting with, parts of it.

The simplest form of systematic knowledge is description of the concrete, wherein a *series* of propositions is employed to symbolise the set of qualities and relations which *co-exist* in a real object. Our assurance that they do co-exist in the object is based on two distinct experiential grounds—(1) the direct observation of certain co-existences; (2) the inference, from experiment, of certain other co-existences.

(1) An object touched may strike us as at once hard and cold. An object seen has colour, united with a certain apparent magnitude and a certain apparent shape. An object viewed while being held or handled has the above visible qualities, united to the tangible qualities of resistance, and of the real or solid magnitude and shape which we measure roughly with our fingers. If we let the object fall to the ground, we may note that the

sound of its fall coincides with the arrest of its visible motion. Of course, these co-existent impressions cannot be simultaneously named and classified in thought; but the moment we reflect upon them it is clearly recognised that they were simultaneously perceived.

(2) Whenever an object is of a nature to be freely experimented with (as, for instance, an orange, which we may view from a distance, hold in the hand, throw into the air, drop to the ground, roll on a table, smell, taste, and cut with a knife), we find that the various impressions characteristic of the object do not follow any law of succession of our own states of consciousness, but may be obtained in any order and repeated as often as we please, while the object itself remains either visibly or tangibly intact. Hence we naturally infer that those successive impressions made by the object on our senses are derived from qualities which co-exist in the object itself.

Thus, even if it were granted that all the attributes of an object are phenomena, we should be compelled to regard the object itself, which is the source of indefinitely numerous phenomena, as something other than a mere phenomenon. It would not do to call it a complex phenomenon; *it* could not be a phenomenon at all unless all its phenomenal attributes appeared simultaneously as a complex sensation; and there is no object known to science whose attributes have ever thus appeared.

But I am by no means prepared to grant that attributes as such are phenomena.

Necessarily the first apparent qualities of an object to be observed are the direct impressions which the object makes on our organs of sense. These are phenomena, in the proper sense of the term ; and our first notion of concreteness is of the complexity of phenomena exhibited by some familiar object. But it is clear that these apparent qualities depend upon the object being brought into a certain relation to ourselves ; and whenever objects come under observation, it is equally clear that they have relations to one another as well as to ourselves. When we recognise that two vases are a pair, or that they stand about four feet apart, or that a person, not ourself, lifts one of them out of its place, we are aware that the relations of kind and position between the vases and the relation of effect and cause between the movement of the vase and the action of the person who lifts it are distinct from the relations of the objects to our organs of sense ; notwithstanding that the latter relations are essential to our perception of the former ones. Relations which are thus observed to exist or take place between objects, not being mere relations of the objects to the observer, may be termed objective relations. These objective relations are the ultimate data of physical science. Although at first presented among the phenomena of sensation, they cannot be conceived as being, in

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themselves, mere phenomena. They belong to objects as objects; not to the appearances which symbolise objects in our passing perceptions, nor yet to the notions which symbolise them in our reflective thoughts.

It is generally possible to corroborate the fact that objective relations exist, by combining the evidences of two or more different senses. A space relation of terrestrial objects visually perceived may be tactually measured, either with compasses, rule, or measuring tape, or, more roughly, with the span of the fingers or the arms, or by walking and counting our steps. However, in the case of walking, or any other series of connected movements, we appeal to a noumenon rather than to phenomena. The consciousness of a single step is a tactual phenomenon; but the consciousness of walking involves the memory of several past steps blended with the feeling of the step which is being immediately taken.

Touch and sight are the two senses from which we chiefly obtain objective information; but the true organ of perception is that part of the brain (? the *phronema* of Haeckel) wherein impressions of touch and sight are instinctively compared and correlated. This process of correlation leads to the elimination of the more subjective elements of touch and sight respectively. We learn that our tactual feelings of heat and cold, and our visual feelings of light, shade, and

colour, do not belong to objects, as such. What do belong to objects are the qualities, such as shape, magnitude, motion, and resistance, which Locke distinguished as primary; and the progress of physical science consists largely in interpreting the subtle phenomena of sound, light, heat, electricity, chemical agency, and life and consciousness themselves, in terms of matter and motion, or, as I should prefer to say, of objects and movements.

It is noteworthy that this objective interpretation of phenomena must necessarily confine itself to explaining the relations of things which the phenomena symbolise. It cannot explain the subjective quality of any phenomenon. The simplest sensation is, in its intrinsic character, physically inexplicable. A materialist would say that it does not need explanation; it is enough to know that certain sensations are invariable concomitants of certain processes of the brain. But it is only some processes of the brain which give rise to consciousness, and those which do so have a very different value from those which do not. The effects of the former could never be inferred from their physiological character, unless their psychological concomitants were given. When an animal takes to flight on perceiving another animal which it instinctively infers to be a dangerous enemy, the facts of perception and inference supervening on certain processes of the nerves and brain are needed, no less and more obviously than the nerve and brain

processes themselves, to explain the whole effect. Thus, if we admit that science involves determinism, it does not by any means follow that it involves a belief in the automatism of human and animal actions. The physical processes which subserve consciousness would not produce the results they do produce were it not for the reality of the consciousness which accompanies them. These and similar considerations seem to have led Professor Haeckel to the view, essential to his famous Monistic hypothesis, that some mode and degree of consciousness is coeval with the movement of matter. This is not the place to pronounce judgment on that far-reaching theory : I merely allude to it in passing. The fact to which I especially wish to direct the reader's attention is that those familiar states of consciousness which are phenomenal in themselves—that is, as viewed introspectively and according to the method of analytic psychology—are, when considered concretely and as joined to appropriate processes of the brain, seen to form parts of psycho-physical noumena, whose objective effects differ widely from the objective effects of noumena which are purely physical, in the ordinary sense of these words.

From the point of view of theory of knowledge, we may take the science of optics as the fundamental physical science. This it is which explains the relation of visual phenomena, in their general outlines, to objects physically conceived—that is,

conceived at once with the *intimacy* of touch and the *accuracy* of sight. Tactual phenomena are relatively original; visual phenomena, relatively symbolic; but touch, when unaided by scientific instruments, gives only a very rough impression of real magnitude and figure, whereas sight gives a clearly-cut impression from which, according to the laws of optics, real dimensions can be accurately inferred. And, in the case of those objects which are inferred to exist, though absent, and of those which are inferred to exist, though never visible even by aid of the microscope, any knowledge we may obtain is inevitably of a quasi-optical character.

Thus the cosmos assumed by physical science is essentially noumenal. The phenomenal world exists for feeling and seeing, for painting, for descriptive literature, for psychology and sociology, but not for the so-called natural sciences. All these sciences are concerned with objective relations, to the exclusion of that subject-objective relation implied in the fact of sensation. That relation is the most important object-matter of psychophysical science. What takes place in a psychological laboratory is a deliberate comparison of the phenomena of consciousness, in respect of duration, intensity, etc., with physical noumena. The scientific instruments with which such a laboratory is equipped—they, and all their ways of working—are physical noumena, contrived, in conjunction with those other physical noumena, the corporeal

operator and corporeal subject, to record and measure phenomenal occurrences; such as perceptions and inferences following on given stimuli. In a laboratory devoted to physics there are instruments more or less similar, but no phenomena are in question; since the experimenter's personal and momentary observations, which *are* phenomena, are, in every case, taken as mere signs of the physical noumena observed. Were they taken as more than mere signs, this would be tantamount to a confession of subjective bias and consequent uncertainty on the experimenter's part.

§ 24. *The Knowable and the Unknowable.*

It is a serious misnomer to speak of "the unknowable" when we refer to the fact that reality transcends knowledge. Knowledge can neither *be* primary reality nor can it *substantially resemble* primary reality (compare § 9). Nevertheless, it can actually *be the knowledge of* primary reality; as involving a correct symbolic reference thereto.

Knowledge, be it remembered, does not *comprehend* things, except in a metaphorical way. A real class comprehends all its instances. A real object comprehends all its attributes. Knowledge, as such, comprehends neither the instances nor the attributes. It symbolises the instances by reference to typical examples, and symbolises the

attributes by means of logical predicates. If the examples are well chosen, we do thereby know the class; and, if the predicates are properly applied, we do thereby know the attributes. Since the essential character of knowledge is progressive symbolisation of reality, the actual transcendence of knowledge by reality does not constitute any disability to know, in the legitimate sense of knowing. The possibilities of knowledge are as boundless as the actualities of nature.

Thus, where Herbert Spencer postulates an Unknowable Absolute, I can only perceive that relatively known Reality which transcends knowledge. It may be that we can never adequately explore the absolute intension of even the simplest object. It seems certain that we can never gauge the immensities of time and space. But neither can we explore or gauge man's innate capacity for knowledge; only a remote futurity can reveal its limits. Is the Absolute the Unconditioned? Of the Unconditioned we know nothing, and cannot even conceive anything. It is of the essence of natural objects and occurrences to condition and to be conditioned; and why should the existence of conditioned things imply the objective existence of the Unconditioned, any more than the existence of real things implies the objective existence of Unreality?

The realisation of Nature as the system of natural noumena does away with the supposed

necessity for a supernatural or unknowable noumenon as a peg on which to hang phenomena. We cannot logically draw from the fact that knowable Nature transcends knowledge any inference as to what does or does not lie beyond knowable Nature. If Nature transcends knowledge in certain respects, as she does, there *may* be something transcending Nature, such as we symbolically know her to be ; but we cannot ascertain that there is any such ulterior thing without performing the impossible feat of placing ourselves outside Nature. The very words, "beyond," "above," "super," "transcending," apply originally to relations of space, and, although transferred, by legitimate metaphor, to relative positions in the scales of evolution, of human society, and of mental achievement, they become practically meaningless when employed to suggest a supposed reality which is neither cosmological nor yet biological or sociological.

Thus the outcome of objective logic, bearing on the limitations of human knowledge, is a purely agnostic attitude as regards what is ultimate in reality. Objective logic neither asserts nor denies that the natural universe is uncreated and self-existent. It neither denies nor asserts that some hidden Power produces and sustains the whole. It does, however, preclude any attempt, such as that of Herbert Spencer, to divide the real universe into knowable and knowably unknowable sections.

Spencer conceives, as the background of Nature and the last refuge of religious sentiment, an Unknowable Absolute, known to exist. Objective logic points to the modal polarity of Substance and Nature, as forming the limit of knowable reality. It refuses to speculate on that which cannot be described in terms of Substance or Nature. That which is not Substance, or dependent on Substance, not Nature or included in Nature, is absolutely unknowable, alike as regards its attributes and as regards its existence or non-existence.

PART II.

THE DISTINCTIVE GROUNDS OF THE SCIENCES

§ 1. *The Place of a System of Sciences in the Philosophy of Knowledge.*

REVERTING to the analogy between harmonised knowledge and the human organism, which was noted in the Introduction, pp. 14-19, it will be seen that Part I. of this treatise has been occupied mainly with that relation, between subject-matter and object-matter, which was compared to the cell-structure of the organism. The aim has been to determine the marks of health and vitality in the knowledge-cell ; literally speaking, to ascertain the most general criteria of the correspondence of truth, as subject-matter, to real object-matter. These criteria have been found to consist in (a) the symbolic relation of the secondary order of logical thought to the primary orders of sensuous experience and inferred physical reality ; (b) the identity of general object-matters (= the object-matters of general ideas) with the singular instances whose natural agreement forms the basis of our mental act of generalisation ; (c) the identity of

abstract object-matters (= the object-matters of abstract ideas) with certain real attributes of objects—that is, of concrete object-matters—whose natural distinction from other real attributes of such objects forms the basis of our mental act of abstraction.

Having, so to speak, discovered the cell of knowledge, objective logic may proceed to investigate the anatomy of knowledge, regarded as that complex quasi-organic subject-matter which it is. As was previously pointed out, there are distinct sciences which stand to one another as the separately-located organs of the human body, while there are also general principles of all science, or of important groups of sciences, which are comparable to the pervading structures of the body ; such as the skeleton, the muscles, the veins and arteries, the nerves. Thus objective logic has two distinct aims over and above its original purpose of defining the general relation of truth to reality : (1) To establish a system of the sciences correspondent to the system of things ; (2) to explain the valid methods of science as based upon (*a*) the subjective facts of human consciousness, out of which all subject-matter of science arises ; (*b*) the permanent and universal modes and relations of things, including, but not confined to, causation, which are present among the object-matters of all or many particular sciences. In other words, one part of philosophy of knowledge treats of the

distinctive grounds of the sciences ; another part, of the uniting principles of science. The latter investigation has been anticipated to some extent in Part I. of this essay ; but it admits of being, and requires to be, treated with much more elaboration of detail. This treatment, however, can only take place after a clear survey has been made of the field of recognised knowledge in its principal divisions. The remainder of the present work will, therefore, be devoted to a classification of the various sciences, the fuller discussion of the uniting principles of science being held over for treatment in a subsequent volume.

§ 2. *The Meaning of "A Science."*

A science = a branch of science = a subject-matter having a definite object-matter, which is inferred from experience, and is of sufficient extent and complexity to afford an ever-recurring occupation to the minds of those who study it systematically.

In the foregoing definition it is assumed that science covers the whole field of reasoned knowledge, and also includes all scientific hypothesis which is advanced as hypothetical and not confused with ascertained truth. Science is not simply systematised opinion, since systematised opinion comprises various dogmatic creeds and pseudo-sciences ; but, given a genuine object-matter, approachable by experiment, observation, or

deliberate and unbiassed introspection, then the very fact of approaching it in any of these ways leads up to legitimate science. No doubt many persons use the term "science" in a sense much more restricted than the above. As "nature" may mean physical nature alone, so "science" may have the cant significance of physical science; the studies of language, thought, abstract mathematics, human history, and "the humanities" in general falling, according to this view, outside of science. Again, there are those to whom the ascertainment of laws expressible in precise mathematical formulæ appears to be the *sine qua non* of science; and there are others who conceive science exclusively in the positive mode, as opposed to all branches of knowledge which prescribe regulations for human practice or standards for human endeavour. Such branches of knowledge may be thought to be arts, in antithesis to sciences; but in fact they are *the sciences of arts*; the arts themselves being the habits of acting in particular ways, physically, socially, or intellectually, which in many cases can only be acquired through innate skill, character, or genius, and can in no case be mastered except by practice and perseverance over and above the adoption of rules or ideals. Yet none of the higher arts of civilised life can exist and progress without the correlative branches of science, which define their ends and describe their methods.

I conclude, then, contrary to the above-mentioned

and other arbitrary limitations which it is sought to impose on the meaning of "science," that, wherever there is a possibility of classifying and investigating some permanent group of related objects or facts, whether independent of, or involving, the conscious faculties of mankind, and whether leading to, or not leading to, the formulation of exact mathematical laws, there is legitimate scope for the establishment of a science.

The sciences are simply the most highly elaborated and most internally harmonious subject-matters of human reflection.

§ 3. *The Degrees of Distinction between Sciences.*

As pointed out in Part I., § 7, every genuine science corresponds to some real object-matter which has a far wider extension and far deeper intension than itself, as subject-matter. This we may infer, not only from the general relation of truth to reality, but also from the possibility of ceaseless progress—of continual conquest of the unlimited unknown by knowledge—which every genuine science affords.

Sciences being naturally subordinate to their object-matters, any valid division between two sciences must depend upon some real distinction between their respective object-matters. Such real distinction need not, of course, be mutual exclusion, but may be distinction in either of the three degrees alluded to in Part I., § 12.

There are many and important cases in which the object-matter of one science includes that of another. The universe known to astronomy includes the earth—the object-matter of geography, geology, etc. Organisms, forming the object-matter of biology, include those particular organisms, human beings, which are treated of by anthropology. The object-matter of physics, being energy in all its modes, includes that of the science which treats of light, a particular mode of energy. All reality, as relatively known, being the object-matter of objective logic, includes the object-matter of any less universal science. In all these cases there is an including and an included object-matter; the two object-matters being therefore distinct in the first degree.

When, however, the object-matter of one science includes that of another, it does not follow that the subject-matter of the first science *actually* includes that of the second. For practical convenience in the pursuit of such sciences, their subject-matters assume an overlapping relation, and even tend to become mutually exclusive, in so far that the second science treats its peculiar object-matter with a regard to details which would be wholly out of place in the wider outlook demanded by the first science. The first becomes a relatively extensive, the second a relatively intensive, science. Thus, in astronomy, the earth is referred to rather as the best-known instance of a planet than as the theatre

of all the events which geology, biology, and the other earth-sciences take note of. In biology man is viewed as one among the other animal species, but the varied arts and historical records of human life are left for the distinctively anthropological sciences to discuss. Physics must, indeed, be supposed to cover the science of light; yet the latter science may be elaborated in a way not demanded in an elementary treatise of physics. In objective logic all object-matters of science are glanced at, but it is not possible to treat any of them in its technical detail. All are contemplated only in their relation to the subject-matter of science, as giving rise either to distinct branches of science or to distinct methods in its pursuit or application. Nevertheless, whenever the object-matter of one science includes that of another, the first science has, as it were, a right of entry into the territory of the second, so that the subject-matter of the second does not strictly exclude that of the first.

Of sciences whose object-matters are distinct in the second degree, we may take the case of *peri-biology*¹ and geology, or that of philology and logic. While rocks are formed fundamentally of inorganic materials, some rocks contain, or even

¹ The term "*peri-biology*" is here and elsewhere employed to signify the science of those inanimate objects, including organic remains, which are due to, or modified by, organic action; biology itself being the science of organisms themselves, as at some time living and acting.

largely consist of, organic remains ; thus geology and peri-biology overlap in palæontology. While philology is concerned especially with the grammatical form of language, and logic especially with its rational import, both sciences are concerned with the fact and the use of language. They have, therefore, in addition to their distinct object-matters, an object-matter in common ; and thus stand to one another in the over-lapping relation.

Of sciences whose object-matters are distinct in the third and highest degree, of mutual exclusion, we may take the concrete sciences of entomology and numismatics, or the abstract sciences of psychology and geometry. Insects and coins are separate classes of objects, having nothing in common save the fact of being solid aggregates and whatever that fact implies. Hence, since neither entomology nor numismatics is concerned with the physical fact of solid aggregation as such, the two sciences are seen to be, like their two object-matters, mutually exclusive. The respective object-matters of geometry and psychology are equally distinct, though in a different mode of distinction. Extended form and the current of consciousness may belong to some of the same objects ; namely, to man and other conscious animals ; but the current of consciousness cannot be conceived in terms of spatial dimension, nor can spatial dimension be conceived in terms of the current of consciousness. Thus, geometry and psychology, with their respective

object-matters, are mutually exclusive on the abstract plane.

While we thus see that two sciences may stand to one another in either the first, second, or third degree of distinction, it is clear that a comprehensive system of science must proceed by exhibiting the subordination of sciences whose object-matters are distinct only in the first degree. All object-matters of the sciences are object-matters of science as a connected whole ; all lie within the purview of objective logic. Thus the relations of those sciences which are mutually exclusive and of those which overlap one another can only be explained with reference to the positions which such sciences occupy in the larger whole of which all form parts.

§ 4. *Sciences, Concrete and Abstract.*

In addition to the degrees of distinction between sciences, it is necessary to take note of several very important *modes* of distinction. Sciences may, in the first place, be distinguished as either concrete or abstract.

A concrete science = a science which has for its object-matter some class of objects, or some unique object or unique collective group of objects, considered as far as possible in its whole nature.

An abstract science = a science which has for its object-matter some quality or relation or defined set of qualities or relations, either of all objects or of all examples of some class of objects.

Thus, astronomy, being concerned with the celestial bodies in all their ascertainable relations, is a concrete science, while trigonometry and spectrum analysis are abstract sciences, having special importance for the study of the heavens, but clearly not covering that study as a whole. Again, biology, the science of organisms in all their relations, is a concrete science; while morphology, physiology, and psychology, as concerned respectively with the forms and structures, the physical functions, and the consciousness or sensibility of organisms, are abstract sciences.

§ 5. *A Method of Symbolising the Sciences.*

The distinction between the respective object-matters of the concrete and abstract sciences may be diagrammatically represented by that between a system of concentric circles and certain sectors of those circles. This type of diagram was employed in Figure 6 (p. 74) to illustrate the distinction between material and logical components. Now the object-matters of the concrete sciences are the material components of the known universe, while those of the abstract sciences are its logical components or are logical components of some of its contained objects. The material components do not exclude the logical ones, but include them in their own concrete mode, just as the concentric circles include, in their mode of

whole circularity, the defined sectors which fall within them.

Figure 8 furnishes a simple illustration of the application of the above type of diagram which I propose to make throughout the following discussion of the sciences.

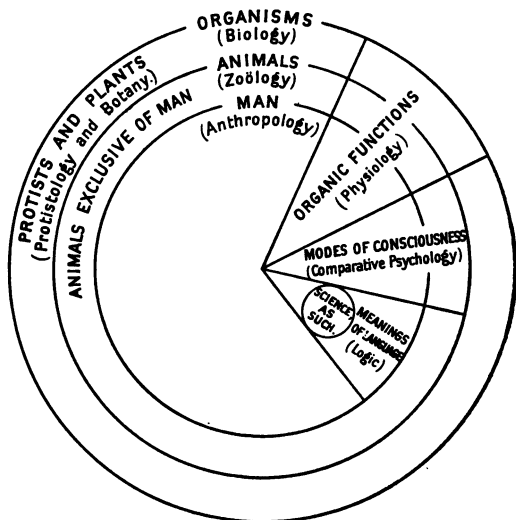


Fig. 8.

Here we have living organisms, the concrete object-matter of biology, represented by the whole area of the outermost circle. Organisms include animals, the concrete object-matter of zoölogy, for which the middle circle stands. Animals, in turn, include man, the concrete object-matter of anthropology, symbolised by the innermost of the three circles. The two zones stand respectively for the

organisms which are not animals and the animals which are not men. The sector extending to the circumference of the outermost circle typifies those life functions, some of which are common to all living organisms; functions which form the object-matter of the abstract science of physiology. The inner part of this sector stands naturally for animal functions, and the innermost part for human functions. The second sector, extending only to the circumference of the animal circle, must be taken to represent consciousness, the object-matter of comparative psychology; the latter science being, at least for all practical purposes, confined to investigating the consciousness of man, and that of other animals in so far as it may be inferred, from their nervous systems, sense organs, and observed actions, to bear some resemblance to the human type. Lastly, the sector which extends only to the circumference of the human circle stands for meanings attached to language and forming subject-matter, which is the special object-matter of logic.

In all subsequent diagrams, as in Figure 8, a name inserted in the circumference of a circle must be understood to designate a concrete object-matter, which is represented by the whole area of the circle; while a parallel name between two circumferences will denote a concrete object-matter comparable to the zone included within the outer, but excluded from the inner, circle. A name written in the direction of the radius of a circle, or system of

circles, must be understood to signify the object-matter of an abstract science, as represented by the sector in the middle of which the name appears.

If, however, it be desired to analyse an object-matter of abstract science into two or more constituent object-matters, the name of the comprehensive object-matter may be turned round and

written parallel to the circumference of the circle, so as to make room for the names of the constituent object-matters, from which it will be divided by a dotted arc only. Figure 9 illustrates this mode of symbolisation.

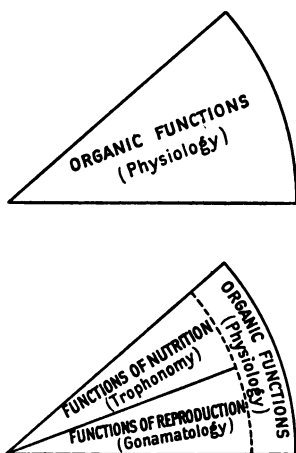


Fig. 9

The names of the sciences as such will be given, in parentheses, below the names of their respective object-

matters; but it must be understood that the concentric circles and sectors represent the object-matters of science, not the sciences themselves. All sciences (= subject-matters of science) must be viewed as contained within a minor ex-centric circle ("Science as such," in Figure 8) lying wholly within the sector which symbolises logical

meaning. This circle stands for the subject-material epitome of the object-material universe ; so that the student must, in imagination, transfer all the italicised terms in parentheses to their appropriate positions within it, bearing in mind that the biological circle is itself included in a larger cosmological circle not shown in this figure.

§ 6. *Sciences, Specialising and Generalising.*

Since the relation of the abstract to the concrete is the ground of a fundamental modal distinction between sciences, it may be well to inquire whether the allied relation of the general to the singular has any similar bearing on the classification of the branches of knowledge. It is certain that we cannot describe some sciences as general and others as singular, since every science employs general terms and propositions, and, at the same time, refers, for verification, to singular instances of the objects described or the relations asserted. But singular objects may be either uniform with the other objects belonging to their species or relatively unique, and many of the latter objects possess a degree of uniqueness or of unique importance for mankind entitling them to special attention. In fact, while some sciences touch upon singular objects simply as illustrating general principles, other sciences are concerned primarily with the unique character of certain singular objects (individual or collective), even though seeking to

explain their very uniqueness by reference to natural laws (= abstract uniformities).

Sciences of the latter class will be termed *specialising sciences*; those of the former class, *generalising sciences*.

It is clear that human history, so far as it assumes the character of science at all, is specialising science. If the circumstances and characters of the various great historical nations were not unique, there would be no national histories; the generalised history of a typical nation would serve equally well to describe the varied glories of ancient Greece and Rome, or of mediæval and modern France and England. If certain individuals were not uniquely placed by political fortune, or uniquely dowered by nature, there would be no historical characters. The rulers, the leaders, the teachers and creators among men would all be described and dismissed by some generalised formula of what constitutes a human being. But the concentration of interest on unique object-matters is not by any means confined to the anthropological sphere. Several of the most important cosmological sciences agree with human history in being specialising sciences. Take the cases of astronomy and physical geography. We may classify the object-matters of astronomy as suns, planets, satellites, etc., and may derive certain general laws from the characters and movements of these bodies; but, after all, the main interest and importance of

astronomy lie in determining the relations, to *our* planet and to one another, of *the* sun, *the* moon, Venus, Sirius, and the other unique celestial bodies. Similarly, the geographer may define capes, peninsulas, islands, lakes, etc.; but it is the unique instances of these features of the earth's surface, localised and known by their proper names, which form the main topic of physical geography. Geology, again, is concerned with the unique series of rocks forming the earth's crust ; and phylogeny, with the unique totality of organic species branching from one continuous stem of terrestrial life.

The principal concrete specialising and generalising sciences go in pairs ; the object-matter of such a pair of sciences being identical as matter ; but the specialising science regarding this matter in its actual distribution in large and complex aggregate forms, while the generalising science regards it analytically, classifying the constituent substances of which the great aggregates are found to be built up.

The most striking and important instance of this fact is afforded by the relation of astronomy to chemistry. Each of these sciences has for its object-matter the whole ponderable matter of the universe ; but, while astronomy is concerned with the most colossal aggregates in which matter is known to exist, chemistry treats of the minute ultra-visible particles of which these gigantic

bodies are composed. Intermediate between these extremes come the earth-sciences of geology and mineralogy. These two branches of knowledge are alike concerned with the whole solid substance of the earth ; but, while geology is, as we have seen, a specialising science, treating of the great strata composing the earth's crust, mineralogy is a generalising science, which extracts and classifies samples of the various substances entering into and together constituting the geological strata.

Since, then, astronomy and chemistry on their part, and geology and mineralogy on theirs, are concerned with the self-same matter under different aspects, neither science in either pair can be said to include the other, and, if we adhere to the system of representing the sciences outlined in § 5, specialising sciences will have to be treated independently of generalising ones, and symbolised by independent diagrams.

We need, however, in the first place, a diagram covering the whole ground of science and ignoring the distinction between the specialising and generalising sciences. This may be obtained by grouping together the sciences of astronomy and chemistry under the head of cosmology, as the concrete science of supreme extension ; and, again, by viewing geology, mineralogy, geography, etc., as branches of a comprehensive earth-science, or geognosy.

I propose, in the following pages, to discuss the

concrete sciences at some length before proceeding to treat of the abstract ones. In § 7 it will be sought to lay down a fundamental scheme of the concrete sciences. This, in § 8, will be reproduced, with the variations due to including the specialising concrete sciences ; and, in § 9, with those due to including the generalising group.

In classifying the sciences on the foregoing principles, I have found myself confronted with various logical divisions of knowledge which are not commonly recognised as distinct sciences, but which, nevertheless, seem to me to be potential sciences, or, at least, departments of science which deserve, for one reason or another, to be distinguished by names of their own. Where possible, I have sought appropriate designations for these departments from among the many existing, but little used and ill-defined, names of sciences which one may find in the dictionary. "Geognosy" is a case in point. In some instances, however, I have been obliged to coin the names required, and have done so with diffidence, recognising that philologists and the men of science whose spheres of research are in question will have to acquiesce in the nomenclature before it can pass current, and that very likely more appropriate names may be bestowed. These tentatively-coined terms are marked with a †.

§ 7. *The Fundamental Concrete Sciences.*(See Figure 10—*a* and *b*.)

COSMOLOGY = the science of the universe, or of the connected totality of material objects. Directly or indirectly all sciences may be brought under this broad heading ; yet cosmology is chiefly concerned with the inorganic order of things—the celestial bodies, the structure of the earth, and the chemical elements. It relinquishes to biology and anthropology respectively the intensive study of the facts of life and human nature. From the cosmological point of view, organisms are of interest mainly in so far as they are built up of inorganic materials, under the influence of physical modes of energy and of those physical conditions obtaining at the earth's surface, and, also, in so far as their own action, unconscious or purposive, works changes in the inorganic substance of the earth.

GEOGNOSEY = that branch of cosmology which treats of the earth, and of the minor bodies which form parts of it or exist within its sphere.

Cosmology and geognosey are not specialists' sciences. Each depends rather upon a philosophic synthesis of distinct contributory sciences which are commonly pursued as separate studies ; general cosmology depending upon astronomy and chemistry, while geognosey is indebted to geography and geology respectively. It is clear, however, that the object-matters of these distinct sciences—the heavens

and the elements, the surface and the substance of the earth—do not exist in isolation from one another, and may be scientifically regarded in their united aspect, as well as in their distinctive aspects. Such a mode of regarding them gives rise to cosmology, which forms the most appropriate introduction to science itself, in that broadly-outlined form in which

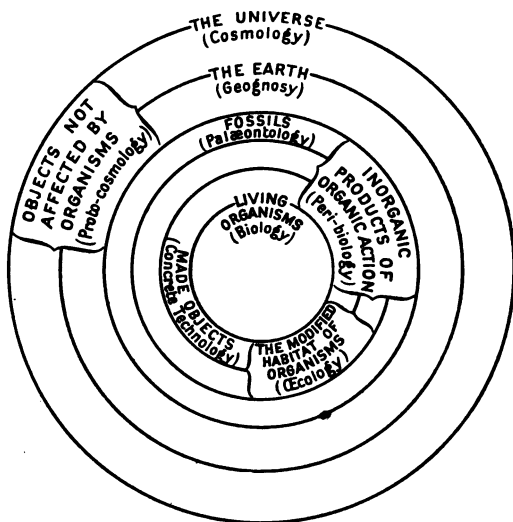


Fig. 10a.

it is suited for assimilation by the average youth at school or the average busy man who devotes part of his leisure to acquiring knowledge. I think that the ideal primer of cosmology, as a whole, has still to be produced; but, so far as geognosy is concerned, it would be difficult to improve upon Huxley's *Physiography*.

†PROTO-COSMOLOGY = that part of cosmology, including a part of geognosy, which treats of inorganic objects as unaffected by organic action.

†PERI-BIOLOGY = that part of geognosy which treats of organic remains, of inanimate organic products, and of inorganic objects as modified by the action of organisms.

Peri-biology has two principal branches.

PALÆONTOLOGY = the science of fossils, or of organic remains met with in the earth's crust.

ŒCOLOGY = the science of the earth as appropriated and modified by inhabiting organisms; hence, of air and water as affected by organic action, of soil as formed from decaying vegetable matter, of caves and trees as utilised by animals for abodes, and, lastly, of burrows, nests, and all other objects due to animal constructiveness.

CONCRETE TECHNOLOGY = the branch of œcology last referred to = the science which treats of objects artificially shaped or constructed from raw materials by the purposive action of animals and men, or by those physical and chemical processes which are set going and controlled by human agency. *Abstract technology* is the science of the processes artificially employed to produce objects; especially, therefore, of the human industrial arts. *Concrete technology* is the science of the produced objects themselves. The former is a biological, and, for the most part, an anthropological science. The latter, though intimately related to biology and

anthropology, is really a branch of inorganic cosmology. Although the objects here considered could not be brought into existence apart from animal or human agency, yet, as they do exist, they consist in the materials and illustrate the formal possibilities and physical laws of inorganic nature. It is probably not too much to say that there would be no science of geometry, no science of physics, and no science of chemistry, if man were compelled to study inorganic nature by observing primary natural objects. It is in the artificial shaping of natural objects that the ideal forms of geometry come to be conceived. It is by the use of tools and machines of various kinds, and, ultimately, of scientific instruments, that the principles of physics are grasped. It is through the practical analysing and re-combing of compound substances, under the artificial conditions of the laboratory, that the real, or relatively real, elements of which the universe is composed came to be named and known.

BIOLOGY = the science of living organisms. By living organisms one of course means organisms viewed in the mode of life—not simply those which happen to be living at the present moment. Fossils and defunct organisms are object-matters of biology precisely and solely in so far as we reconstruct in imagination the animated beings from which they are derived. In themselves they are object-matters of peri-biology. Their organised substance has been returned, or is in process of being returned,

to earth, ocean, or air—those vast reservoirs of inorganic material which has subserved, and may again and again subserve, the purposes of life.

It will be noted that Figure 10 has, for convenience sake, been divided at the biological circle; 10*b* is simply the innermost circle of 10*a*, reproduced on an enlarged scale.

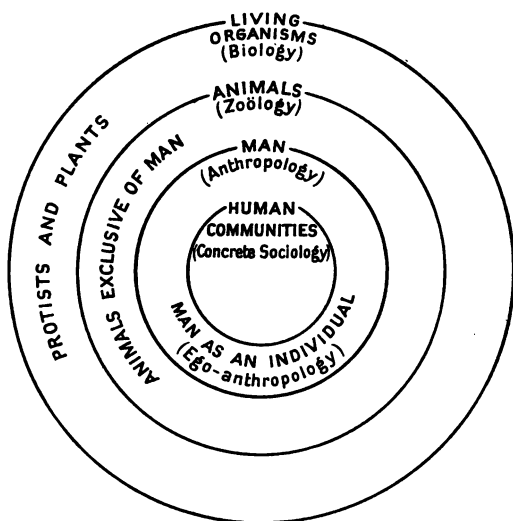


Fig. 10b.

ZOÖLOGY = the science of animals.

†PERI-ANTHROPOLOGY. This term may be applied to the whole zone of concrete sciences, excepting anthropology itself. Although man cannot be supposed to be the absolute centre of the universe, he certainly stands at its centre as envisaged by

human knowledge. While the universe is the object of supreme extension, he is the object of supreme intension—an epitome of attributes which belong to objects in general, to organisms in general, and to animals in general, these being united to other attributes which belong to himself alone. Thus the sciences which lead up to anthropology may be appropriately termed *peri-anthropological*. They are not necessarily non-anthropological; for cosmology, geognosy, biology, and zoölogy actually include anthropology in the mode of extension; while palæontology and œcology, without actually including anthropology, are intimately related to it; especially the latter, as having to do with the earth in human possession, and its materials as shaped by man's art. All sciences, in fact, possess a positive relation to anthropology, as being concerned with things or facts which enter into man's environment and are known by means of human sensation and thought.

ANTHROPOLOGY = the science of man. It is only in modern times that the possibility of a strictly scientific study of mankind has begun to be realised. The place of the science has long been, and still is largely, occupied by a mass of undigested erudition, of classical and ecclesiastical lore, concerned especially with the Greek, Latin, and Hebrew languages, literatures, laws, and traditions, and with their modern survivals in academic philosophy and Christian dogma. The tendency of this mere

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learning, especially on its theological side, has been to present man rather as an isolated enigma than as the most highly evolved terrestrial organism. But now there has arisen a science of anthropology, based on the actual observation of living men in all their different tribes and nations—of their customs, arts, languages, beliefs, and ideals; while the results thus obtained have been reinforced by archæological investigation into an antiquity which the ancient writers of Palestine and Greece were quite incompetent to gauge. Archæology has done much towards restoring to human knowledge the dimly historical stages of civilisation in Egypt, Assyria, and elsewhere; but it has done more than this. It has brought to light significant traces of pre-historic humanity in all parts of the world, thus enabling us to form some conception of the evolution of man, since he became man. It therefore stands to anthropology much as palæontology stands to biology.

The science of man is still, however, in its infancy, and has not come into its full inheritance. While properly opposed to academic pedantry, it needs to assimilate many of the higher elements of academic culture, and to blend these with the higher ideals of social progress. A text-book such as Tylor's *Anthropology* may be full of human interest; yet this interest lies mainly in tracing the evolution of civilisation from primitive conditions. The scope of such a work does not

extend to a critical outline of history or to a description of civilisation at its present most advanced stage; still less to a forecast of the higher conditions towards which humanity is moving, or a separation of the permanently valuable from the transitory and undesirable elements of civilisation, so-called. Yet a certain knowledge of the human world—as, at its best, it is—and of the great historical communities from which civilisation has descended, are integral parts of the science of mankind; and so, I take it, is that constructive doctrine, always liable to err, yet always capable of being broached in a scientific spirit, which seeks to set forth a rational and ideally just constitution of human society, in the belief that men must increasingly respond to the appeals of reason and justice, and so eventually give effect to a type of society which now seems Utopian.

†EGO-ANTHROPOLOGY = the science of man, as an individual, concentrically related to his non-human environment, to other individuals, and to the organised community. The morphology, physiology, and psychology of the typical human being are abstract-general branches of ego-anthropology; while its specialising branch consists in biography.

CONCRETE SOCIOLOGY = the science of human communities—potentially, of *the* human community—regarded in all of their, or of its, relations. This science presupposes whatever can be known

through ego-anthropology applied to the individual units of society, while it further seeks to systematise those relations in which a number of individuals can simultaneously share; viewing every relation in its balanced aspect, as centred equally in any two, or any number of pairs of, individuals. In ego-anthropology, on its part, one always has in view the individual, or typical individual, with the relations centred in his or her personality. A may be related to B as child to parent; to C, as parent to child; to D, as learner to teacher; to E, as teacher to learner; to F, as buyer to seller; to G, as seller to buyer, and so forth; but all these social relations are viewed from the side of A only. In concrete sociology, on the other hand, B, C, D, and a host of other persons, are object-matters quite as pertinent as A, while the relation of A to B needs to be viewed in conjunction with the complementary relation of B to A, and the ulterior relations of B to C, C to D, etc. It is true that any relation of A to B necessarily implies a complementary (either differential or reciprocal) relation of B to A; but the whole relation is not necessarily regarded impartially, from either side in turn. If A be self and B some other person, it is, perhaps, inevitable that one's own part in the relation will be more vividly realised than the other person's part; nevertheless, the progress from selfishness to social fitness depends upon the increasing realisation of the two-sidedness of our

relations to others, due to the putting of ourselves, in imagination, in the place of those others.

Concrete sociology is not, however, limited to the study of the relations between human beings in communities and of those between communities themselves. It must also pay attention to such relations of man to his physical and inferior organic environment as are due to the division of labour in the productive arts, the intelligent direction of industry, and the application of invention to meet, or it may be to create, new demands of civilised life. Furthermore, it must take note of the intellectual relations arising out of the possession in common of language and literature, together with religious, philosophic, scientific, artistic, and educational ideals. Thus concrete sociology is far more comprehensive than the science which may be termed *abstract sociology*, as being concerned with *social relations as such*. Abstract sociology has a strictly limited, though a large, outlook. It treats only of such matters as the forms of government, the making and administering of laws, the customs and unwritten obligations of social intercourse, and the relations, in peace or war, between national Powers. Concrete sociology adds to these facts of human convention the nature of man as an individual, the arts of life, springing from man's collective relation to his environment, and the arts and sciences of the intellect, centering in the common possession

of language. Thus concrete sociology is anthropology in its highest intension.

§ 8. *The Specialising Concrete Sciences.*

(See Figure 11—*a* and *b*.)

ASTRONOMY = the science of celestial objects and their movements, including, as one of its principal

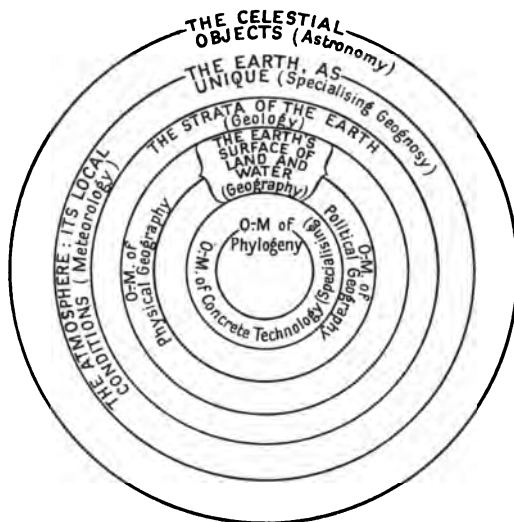


Fig. 11a.

object-matters, the solar system, of which the earth is a single member.

SPECIALISING GEOGNOSY = the science of the earth in its unique character, and covers several important subordinate sciences :—

METEOROLOGY = the science of the earth's atmosphere, considered in its local conditions. Although

bodies of vapour and currents of air are among the most indefinite and transient of objects, yet, as being vaguely distinguishable from other surrounding parts of the atmosphere, they must rank as objects, while, as being met with in particular regions at particular times, they are singular objects. As such they possess a considerable degree of uniqueness. Atmospheric conditions do, indeed, repeat themselves over and over again, but the repetitions are always accompanied by local variations, and it is the chief aim of the meteorologist to learn to predict the particular conditions which will affect the inhabitants of particular districts during particular days or seasons. Hence meteorology is a specialising science.

GEOLOGY = the science of the series of rocks which compose the earth's crust, and of the fossil remains of particular species of plants and animals as characterising the successive strata. Geology thus includes palæontology, as such, though the inferential reconstruction of life in the past from palæontological evidence belongs to biology.

GEOGRAPHY = the science of the earth's surface of land and water. Of course, the surface in question is not to be regarded as a geometrical superficies. It must be understood to include so much of the soil and of the substance of rocks and bodies of water as appears at, or approximates to, the actual surface, or becomes directly accessible to human observation. *Topography* is the term usually applied

to geography, when it treats of the more minute or intimate features of a locality.

PHYSICAL GEOGRAPHY = that part of geography which treats of the features of the earth's surface due to geological formations and elevations, and to meteorological conditions.

POLITICAL GEOGRAPHY = that part of geography which treats of the earth as appropriated by man ; especially of cities and highways, and of the respective territories and boundaries of empires, nations, provinces, and municipal governments.

CONCRETE TECHNOLOGY—SPECIALISING. While the great majority of artificial objects due to human invention and industry can only be taken scientific note of under their respective classes, there are certain world-famous works of architecture, engineering, and fine art—such, for instance, as the Pyramids, the Parthenon, the Sistine Madonna, the Suez Canal—which possess interest for educated mankind at large, and thus become object-matters of concrete technology on its specialising side.

We next come to that science which, in the specialising scheme, takes the place of biology in the fundamental scheme :—

PHYLOGENY = the science of organic species, regarded in their genetic relationship, as branches of a single stem of evolving terrestrial life. One may, of course, distinguish between the phylogeny of plants and that of animals ; but the radical unity of organic life on the earth, and the relation of

persisting to extinct species, are the significant facts for specialising science.

ANTHROPOGENY = anthropology in its specialising aspect = the science of mankind regarded as a branch of the organic stem. The term is here used in a sense parallel to phylogeny, and does not

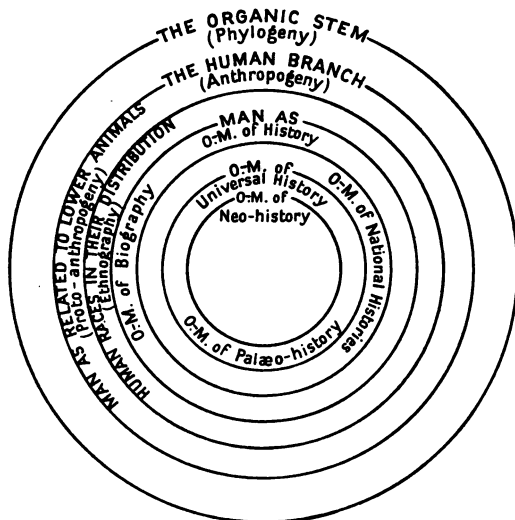


Fig. 11b.

merely allude to the process of human evolution, but to the past and present races and nations of men, viewed as sub-branches of the whole human branch of organic nature.

†PROTO-ANTHROPOGENY = that part of anthropogeny which studies the relation of the human branch to the spreading tree of organic life.

Haeckel's *Evolution of Man* is a typical treatise of this science.

ETHNOGRAPHY = that part of anthropogeny which treats of the races of mankind in their past and present distribution throughout the habitable globe.

HISTORY = that part of anthropogeny which records the characters and actions of nations and notable individuals. Of course, so-called history contains an immense number of ostensible records which are anything but scientific; yet genuine history is scientific, firstly, as involving accurate observation and description on the part of original chroniclers, and, secondly, as involving an exhaustive comparison of documents and unbiassed deduction of conclusions on the part of scholars who seek to reconstruct any past historical period from the imperfect and often contradictory materials which have been handed down. Although, among the ancient Greeks and Romans, history began to be written in a scientific spirit, with at least the desire to exclude mythological elements, the insistence on strict evidence for written tradition is practically an outcome of the modern era of scientific thought. Hence, it is inevitable that constructive work on the part of modern historians of ancient times should be accompanied by destructive criticism of the myths which mingle with all ancient records.

BIOGRAPHY = the history of noted individuals.

NATIONAL HISTORY. The bulk of history consists, of course, of the respective histories of the diverse nations, empires, or city-states, with which are interwoven the biographies of rulers, reformers, and other illustrious persons. No object would be served by attempting a diagrammatic representation of these national histories; or, rather, the only diagrams appropriate to this purpose consist in the series of maps showing the political geography of the world at different periods.

UNIVERSAL HISTORY = an epitome of the histories of the principal nations, defunct or surviving, as containing the antecedents of the civilised world, such as it is now known to be. Universal history may also be termed the history of civilisation, when civilisation is used in the actual—not the orthogonic or ideal—sense of the term; for the highest and truest type of civilisation has no history—it waits to be born. In yet other words, universal history is the history of mankind, regarded as tending to become, in certain respects, a single community. The foremost peoples of the modern world are, in fact, to a genuine extent knit together by the bonds of moral sentiment, literature, art, science, and commerce, accompanied by a partial recognition of international law, which may in time supersede the era of wars and of that ruinous expenditure on standing armies and navies which is often paradoxically regarded as the great guarantee of peace. Thus, though not yet in a state of stable

equilibrium, the more civilised and powerful portion of humanity is acquiring an increasing unity and consistency ; and the history of civilisation tends accordingly to become the history of *the* community, rather than the history of many communities.

†PALÆO-HISTORY = the history of nations or empires which have become politically extinct, while contributing in various ways to the course of subsequent civilisation. This part of history has the two sources, classical scholarship and archæological investigation.

†NEO-HISTORY = the history of the nations which persist and form the present world of humanity.

Neo-history is, in turn, divisible into the past history of surviving nations and their contemporary history ; the latter covering events which have occurred well within the memory of living individuals.

§ 9. *The Generalising Concrete Sciences.*

(See Figure 12—*a* and *b*.)

The concrete generalising sciences are those concerned with objects as being of given kinds, but not as being unique or uniquely situated instances of their kind.

†ETHEREOLOGY = the science of ether.

So far as ether is a single universally diffused object, linking together the unique celestial bodies known to astronomy, it may be regarded as an object-matter of astronomy—that is, of a specialising

science. It is not by viewing it in this aspect, however, that we can hope to attain to any definite knowledge of its composition. When comparing its nature with that of the ponderable forms of matter, we must in imagination, even if we cannot in fact, take samples or limited volumes of it, just as we take samples of air to infer the composition

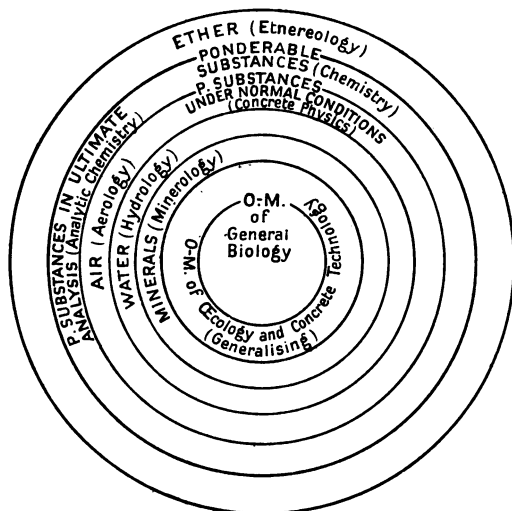


Fig. 12a.

of the atmosphere, or of sea-water to infer that of the ocean. Thus conceived as a uniform ultra-chemical substance, parts of which may be taken to represent all other parts, ether becomes, or may conceivably become, the object-matter of a generalising science, for which I have suggested the name "ethereology." Although it may be the fact, as Professor Haeckel

and many other scientists suppose, that the ponderable forms of matter are condensed parts of the same universal substance as ether, it is certain that they are not parts of that attenuated ether which we know as the great medium of light and other vibratory modes of energy. If not substantially different from ponderable matter, ether is at least substance in a radically different condition. Thus ethereology, which, as a generalising science, may be placed in the outermost zone of the cosmological circle, would seem to have a field quite distinct from that of chemistry.

CHEMISTRY = the science of ponderable substances, regarded as dependent on the relatively ultimate, molecular or atomic, bodies of which they are composed.

In Figure 12a the object-matter of chemistry is symbolised by the concentric circle second from the outside. This, it must be remembered, is properly a circle, not a mere zone; since molecules or atoms are the universal ingredients of all the aggregated forms of matter, both inorganic and organic.

ANALYTIC CHEMISTRY. This term may be employed to denote chemistry in its distinction from concrete physics; as taking note of the elements into which all substances can be analysed, but not of the conditioned forms under which those elements occur.

CONCRETE PHYSICS = the science of the specially-conditioned forms under which chemical substances

occur. Thus the chemical substance, H_2O , occurs, according to temperature, as ice, water, or steam ; while carbon exists, even at the same temperature, under the three forms of charcoal, graphite, and diamond. This latter, however, is a very peculiar fact, while the distinction between the solid, liquid, and gaseous conditions of substance is a fact of universal and every-day experience. Concrete physics contemplates the possibility of all substances occurring under these three forms, and, in many cases, succeeds in proving that substances normally found in one of the three conditions can pass into the other two. However, there is one (mixed) substance in terrestrial nature which is peculiarly representative of the gaseous condition—namely, atmospheric air, and another (compound) substance, which is peculiarly representative of the liquid condition—namely, water. Hence there arise the three following special branches of concrete physics :—

AEROLOGY = the science of air and of the substances which are found mixed with pure air in the earth's atmosphere.

HYDROLOGY = the science of water and of the substances which are found dissolved or suspended in pure water ; in springs, rivers, and seas respectively.

MINERALOGY = the science of the substances which enter into the earth's solid crust.

In each of the three foregoing sciences proto-cosmology and peri-biology overlap, since many of

the substances included in air, water, and rocks, as we know them, are due to organic action; while, in the two former cases, living micro-organisms form an important factor.

ŒCOLOGY AND CONCRETE TECHNOLOGY—GENERALISING. While the appropriation of territory by civilised mankind gives rise to the object-matter of political geography, which is a specialising science, the habitat and modified environment of organisms in general is naturally treated of only in a generalising way; and although, as we have seen, a few of the more stupendous or more exquisite works of humanity merit individual consideration, the great majority of artificial objects are sufficiently described by their class-names and general definitions.

GENERAL BIOLOGY = the study of organisms under their respective species and genera, without special reference to the unity of origin which phylogeny postulates. While the doctrine of evolution forms the key to the connected study of organic life, it of course does not obliterate any of the actual differences between the almost innumerable species of living things. These species themselves, or the lower generic groups into which they fall, afford object-matters of far-reaching interest to the specialists in natural history, and, in this sense, the scientific study of organisms can still be, as it was originally, carried on, without reference to that great synthetic view of life with

which the names of Darwin, Wallace, Spencer, and Haeckel will ever be associated.

General biology has three main divisions.

PROTISTOLOGY = the science of protists, or unicellular organisms. It has long been a controverted question among biologists whether

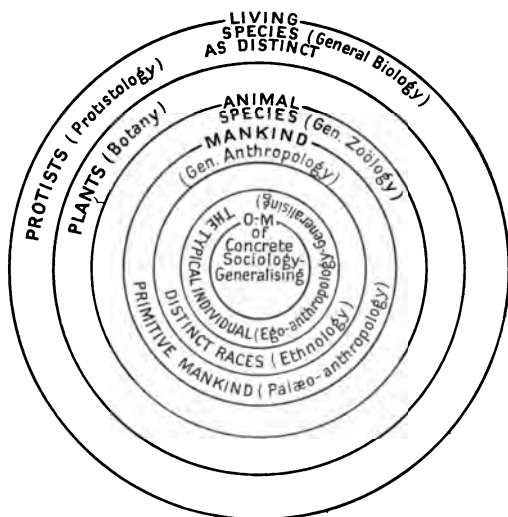


Fig. 12b.

organisms can be exhaustively divided into plants and animals, but it is now fairly clear that they cannot be. We have, at any rate, the great authority of Professor Haeckel for admitting the protists as a third, or, properly speaking, a first, division of the organic kingdom, and for including in this division those interesting, though sinister,

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micro-organisms which have recently acquired so much celebrity—the bacteria.

BOTANY = the science of plants.

GENERALISING ZOOLOGY = the science of animals, considered in their distinct species.

GENERALISING ANTHROPOLOGY = the science of mankind, regarded apart from the unique movement of civilisation.

†PALÆO-ANTHROPOLOGY = the study, from unearthed implements and other remains, of pre-historic mankind, aided by contemporaneous observation of tribes which have not acquired the art of writing, and whose conditions of life, therefore, approximate to the pre-historic.

ETHNOLOGY = the science of the races of mankind, regarding the general characteristics of each race, not the actual distribution of races, which is the object-matter of *ethnography*.

†EGO-ANTHROPOLOGY—GENERALISING. This is the science of the typical human individual, considered not only morphologically and physiologically, but also sociologically and psychologically. Such a science can only exist as a philosophic synthesis of sciences which are usually pursued by distinct bodies of inquirers; by medical scientists, on the one hand; by sociologists, psychologists, and moral philosophers, on the other.

CONCRETE SOCIOLOGY—GENERALISING. Concrete sociology is represented, on its specialising side, by universal history. The term “sociology” is,

however, more commonly employed in this present connection as an attempt to generalise on historical relations. The aim of the science is a true synthesis of the physical and physiological, with the technological, political, moral, and intellectual factors of social life. For the deeper study of these several factors, it is dependent on various abstract sciences which have to be discussed at a later stage.

§ 10. *The Sphere of the Abstract Sciences.*

As indicated in Part II., § 4, the concrete sciences involve the abstract ones, each concrete science being indebted to various abstract sciences which investigate particular relations of its object-matter. At the same time, a single abstract science may contribute to all or to several concrete sciences; a fact which is diagrammatically represented by a sector of the circle of some concrete science crossing several inner concentric circles. Thus, in Figure 8 (p. 124) the physiological sector is seen to cross the biological, zoölogical, and anthropological circles of concrete science.

Of the two related groups of concrete sciences, the specialising ones are those which appeal most directly to the scientific imagination and least directly to the logical reason. They are concerned with unique objects, individual or collective—with the actual contents of the universe, as mapped out by astronomers, and of the earth, as mapped out by geographers—also with the actual series of events

in time, of which the course of human history forms a familiar part. While the least significant real object occupies its own niche in the universe of space-in-time, and is, therefore, *unique in circumstance*, the objects of specialising science are such great aggregates, collections, or systems of things, or such complex individual objects, as are also, to a high degree, *unique in nature*. The objects of astronomy, geography, and history have no known duplicates.

When the variation of objects from their common specific type is too insignificant to demand special investigation, they fall to be considered by the generalising concrete sciences. These sciences are concerned with *samples* of the substances which enter into the great cosmic bodies, and with *typical specimens* of the mineralogical and biological classes. They ignore the unique bodies known to astronomy, geography, and geology, and also the basic unity of terrestrial life, dependent on the phylogenetic connection of distinct species. Thus, in their methods, the generalising concrete sciences are intermediate between the specialising concrete and the abstract sciences. Concrete generalisation and abstraction, which have been, not infrequently, confused with one another, have in fact the common character of ignoring certain features of objects, in order to concentrate fuller attention on the remaining features. But while concrete generalisation is concerned with typical objects which, even as

types, possess an indefinite intension transcending knowledge (compare p. 98, par. 3), abstraction (=abstract generalisation) inquires into certain definite qualities and relations of objects, and ignores the whole complex nature of the objects themselves, so far as it lies outside of the selected attributes. This is the method—the only method—by which exact science becomes possible.

Figure 13a is a diagram representing one of the two most fundamental distinctions in abstract science. The circle stands for the universe — the object-matter of cosmology and of its included concrete sciences. The upper semi-circle sym-

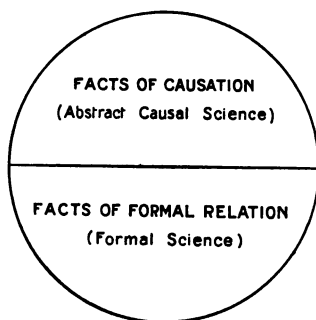


Fig. 13a.

bolises the facts of causation, both of antecedent causes producing effects and of co-existent conditions essential to the existence of objects or their properties; these facts being investigated by *abstract causal science*. We have here to do with causation in the strictly scientific sense; not with supposed original antecedents, nor with supposed final causes; but simply with the mode or way in which, according to accumulated human experience, objects of a certain description are necessary to produce, to maintain, or to effect given changes

in, certain other objects. The lower semi-circle symbolises the facts of formal quality and relation, including the formal-physical relations of number, quantity, time, and space, as such, together with the psychological and logical relations of sensations, emotions, ideas, and terms, as such. These are the object-matters of *formal science*, which purposely ignores those causal relations between concrete objects which give rise to the actual series of events, both physical and psychological.

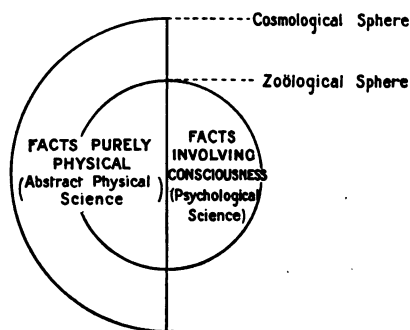


Fig. 13b.

The second fundamental distinction in abstract science, that between the purely physical and the partly psychological sciences, is represented in Figure 13b. *Abstract physical science*

has for its object-matter relations of objects both inorganic and organic—relations which, in themselves, are both formal and causal, but are independent, or conceived to be independent, of any consciousness or purpose in the related objects. *Psychological science*, far from being limited to psychology in the strict sense, has for its object-matter all facts which involve, or are conceived to

involve, the elements of consciousness or purpose. It covers the ground of psycho-physical science, abstract sociology, and the whole science of purposive action, as well as that of formal psychology and logic.

It will be observed, as indicated in Figure 13b, that, while purely physical facts are of cosmological extent, facts involving consciousness are practically limited to the zoölogical sphere. If the cosmological circle in the figure were completed, we should have a semi-zone surrounding the semi-circle of psychological science, which might be taken to represent the hypothetical reality of cosmic consciousness. This "cosmic consciousness" may either mean the mind of deity, pantheistically conceived, or the mind of matter—the energy=consciousness—of Haeckel's Monistic theory. In neither case can cosmic consciousness properly rank as an object-matter of science ; since the only consciousness experientially known is that of man, and the only other consciousness which can be scientifically inferred is that of animals whose purposive actions and nervous systems bear some resemblance to those of humanity. The utmost that Haeckel or any other Monist can reasonably hope to show is that consciousness has its natural physical antecedents, just as living organisms may have their natural antecedents in certain conditions of inorganic matter. Although life and consciousness may be thus derived from more elementary

states of matter and energy, those states do not in themselves constitute either life or consciousness. Life is a peculiar synthesis of energies which *begins* with the living organism, and consciousness a still more remarkable synthesis which *does not begin until* organisms have reached that relatively high stage of development at which a nervous system makes its appearance, and perhaps does not begin even then ; since it is only one part of the functioning of the nervous system in man and the higher animals which is accompanied by consciousness.

The cross-division of the causal and formal with the physical and psychological sciences gives rise to four great sub-divisions of abstract science, which may be termed respectively *formal physics*, *causal physics*, *causal psychology*, and *formal psychology*. These are exhibited in Figure 13c. Formal physics covers the mathematical sciences, both as *pure* and as applied to actual objects in their formal relations of number, time, space, and figure, but not in their causal relations of energy and action. Causal physics covers the principal branches of physics as commonly understood, and also, in its biological application, investigates the physiology and physical relations of organisms. Causal psychology is concerned with the correlation of physical and psychical facts, with the purposive movements of animals, and with the practical arts and institutions of human society. Lastly, we

pass to formal psychology, which is concerned, primarily with the subjective constituents of the current of consciousness, but also with fine art and literature, whose essential objects are to gratify and enlarge the scope of consciousness, and with language and science, the essences of which are understanding and knowledge.

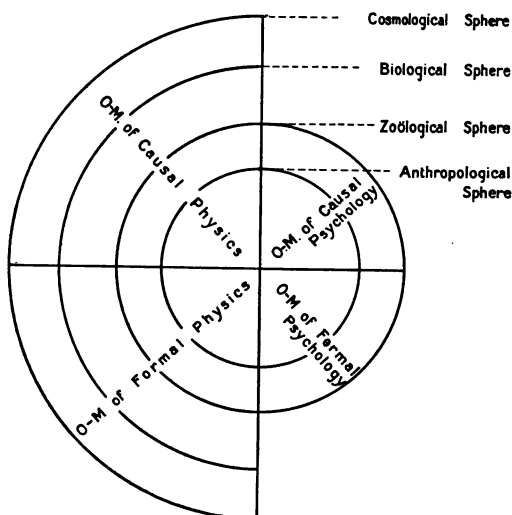


Fig. 13c.

The order in which I have mentioned these great branches of abstract science, and in which I propose to treat of their sub-divisions, may be memorised by supposing the circle of concrete science to be the face of a clock, and following the minute-hand from the half-hour position through

the hour's circuit. This is the logical order ; for causal physics presupposes formal physics, causal psychology presupposes causal physics, and formal psychology, having science itself as part of its object-matter, reflects indirectly upon the whole object-matter of science.

It will be observed that in Figure 13c there are included not only the cosmological semi-circle and zoölogical circle, as in 13b, but also the biological semi-circle and the anthropological circle. This is to indicate that the abstract sciences have to be considered in relation to the above four divisions of concrete science. There are certain abstract physical sciences, such as geometry and dynamics, which are of cosmological extent. There are other abstract physical sciences, such as morphology and physiology, which are of biological extent. Then there are certain psychological sciences, such as comparative psychology, which are of zoölogical extent ; while there are others, such as logic, which pertain solely to the anthropological sphere.

The four following sections will be devoted to these four groups of abstract sciences, taken in the above order.

§ 11. *The Abstract Cosmological Sciences.*

(See Figure 14.)

(a) THE FORMAL PHYSICAL SCIENCES.

Although the group of sciences to which we must now turn are commonly described as

mathematical, they are physical sciences in the formal sense above alluded to. The facts of extension, which constitute the object-matter of geometry, are the very attributes which distinguish matter from consciousness; and, although number and time belong both to the external and the mental series of events, it is fairly obvious that they belong to the latter *through* the former. Real time is such as we measure by means of a time-piece, and this must be regarded as the objective basis of the time which is *felt* to elapse, and which either "flies" or "goes slowly" according to the state of our feelings. Similarly the fact that we can count the distinct contents of consciousness must be supposed to depend on the fact of objective number—the number of concerted brain-functionings to which those conscious states correspond, or the number of external objects and movements which act as stimuli to consciousness.

ARITHMETICAL SCIENCE = the science of number. Number is the most universal of all attributes. As unity, it belongs logically to every object-matter; as duality and plurality it belongs logically to every two or more object-matters considered together. A collective object-matter exhibits a definite (though not of necessity definitely ascertainable) plurality acting in some respects as a real unity; while a general object-matter consists of an indefinite plurality of like object-matters brought under the ideal unity of a class-name.

Arithmetical science may be either generalising or specialising.

ARITHMETIC-ALGEBRA = generalising arithmetical science = the science of number and of

magnitudes which can be compared as consisting in relative numbers of equal parts; number being here either abstract or concrete,¹ but, if concrete, taken only by way of example, and not as representing actual cases occurring at definite times and places. Arithmetic, as taught in schools, is, of course, mainly the *art* of calculation, a mechanical proficiency in

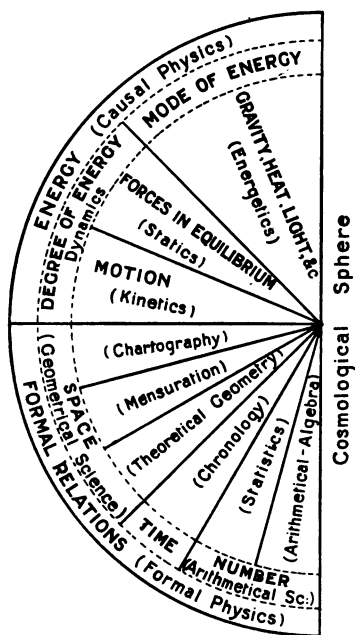


Fig. 14.

which may be acquired with little or no theoretical knowledge of the relations of numbers. Nevertheless, the validity of this practical art

¹ Abstract or concrete in the arithmetical, which is not the same as the logical, sense. Thus, in arithmetic, a number of inches, or of minutes, is concrete; but, in logic, number itself is always abstract, even though it be a number of concrete objects.



must be sought for in the pure science of arithmetic. The art, together with all systems of arithmetical notation, is anthropological; but the facts of numerical and quantitative relationship are cosmological, and it is with these that the science is concerned. It may here be remarked that the notion of number is prior to that of magnitude, since we learn to count distinct objects and occurrences before we learn to calculate the number of conventionally equalised parts constituting a definite quantity of time, space, or energy. Algebra is sometimes spoken of as a science distinct from arithmetic, but in reality it has precisely the same object-matter with arithmetic, and is simply a peculiar method of prosecuting arithmetical science. It generalises, by means of certain symbols, those relations of quantities which, in elementary arithmetic, are expressed by the comparison of definite numbers only.

STATISTICS = specialising arithmetical science = the record and comparison of definite numbers of objects, events, or degrees of energy, as occurring at particular times in particular places.

CHRONOLOGY = the science of time. This is, for the most part, a specialising science, having to do with the unique process of time, in which are embraced the centuries of human history. Our conception of the process does, however, involve certain general elements, which may here be alluded to. The mode of time has the essential quality of

duration, together with the quantitative attribute, measure of duration, and it involves certain relations commonly referred to as co-existence and succession, but which are not adequately classified under these two heads. If we think of points in time—that is, of positions in time without time-magnitude or duration—it is clear that two apparent points must either co-exist (that is, be one and the same point) or not co-exist, and, in the latter case, they must exist in succession. But no natural event can be confined to a mere point in time, just as no natural object can be confined to a mere point in space. Events which appear instantaneous to our blunt senses occupy periods which are prolonged compared to those minute intervals which science infers and even succeeds in measuring. The time occupied by a single beat of a housefly's wing lies far below the limit of direct perception; while an altogether more minute order of durations is involved in the movements of atoms and the vibrations of ether. But the shortest distinct period of motion, as inferred by the most searching scientific analysis, must still be conceived as a period, at least theoretically divisible into fractions of time yet shorter than itself.

The only real points of time, or the only points of time which we are compelled to conceive as such, are the instants in which an individual event or movement commences and ceases; such as the instant when a billiard ball, having been struck by

the player, starts on its career, and the instant when it becomes, relatively to the table, at rest. Since, then, all real events have duration, whether or no it is appreciable to our consciousness, relations in time do not simply subsist as between points of time, but also as between respective durations or parts of time. While the two terms, "co-existence" and "succession," suffice to describe the former relations, the latter will be found to have seven distinct cases, which the reader may, if he pleases, represent to himself by the respective positions of two arrows moving in the same direction, and being of equal or unequal length according as the supposed durations are equal or unequal.

(1) Two events, A and B, begin together and end together.

(2) While A and B begin together, B ends before A.

(3) A begins before B, but B ends before A.

(4) A begins before B, while A and B end at the same moment.

(5) A begins before B ; B begins before A ceases ; A ends before B.

(6) B commences at the instant when A ceases.

(7) A ceases, and, after an interval, short or long, B commences.

Of these seven relations, the first is a case of pure co-existence, while the sixth and seventh are cases of pure succession ; the intervening four being cases of mixed co-existence and succession.

Viewing the above time relations as subsidiary to the fundamental facts of identity and distinction (discussed in Part I., §§ 10, 11, 12), we see that the first, pure co-existence, corresponds to logical identity ; the second, third, and fourth are various cases of distinction in the first degree ; the fifth is a case of distinction in the second degree ; while the sixth and seventh are diverse instances of distinction in the third degree, or mutual exclusion.

Any adequate theory of causation must take the above time relations as its formal bases. Every real cause and every real effect must have duration of its own, and cause may, therefore, stand to effect as A to B in any of the cases (3) (4) (5) and (6), or as in case (7), if we have regard to separated links in a chain of causation.

As already stated, chronology is mainly concerned with time, as the unique process of things ; primarily with the natural sub-divisions of this process, such as years and days, and, secondarily, with the conventional sub-divisions, such as centuries, calendar months, and hours.

The term "chronology" is also, of course, applicable to the art of measuring time ; but the art is ultimately dependent on the science, as envisaging those facts of nature which give us our primary and objective standards of time—the astronomical periods of the earth's rotation and orbit, and of the precession of the equinoxes, and the less definite geological periods marked by the deposition of

particular strata. Probably chronology is the oldest of the sciences—the first branch of knowledge to assume a roughly systematic shape. The alternations of day and night, the moon's phases, and the recurrence of the seasons are facts which must have forced themselves on human attention at the earliest stage of intellectual progress.

GEOMETRICAL SCIENCE = the science of space, and of the figure, magnitude, and relative position of bodies, surfaces, and lines. This science, like arithmetic, may be divided into generalising and specialising branches. The generalising branch is, in itself, divisible into two main sections ; pure, or theoretical, geometry, and mensuration.

THEORETICAL GEOMETRY is concerned with the relations of figures, and with magnitude in relation to figure ; but not with magnitude in relation to units of measurement.

MENSURATION is geometry in which the abstract study of figure and magnitude is supplemented by arithmetic-algebra, applying conventionally determined units of measurement.

CHARTOGRAPHY = specialising geometry = the science which applies geometrical principles to the graphic representation of the earth's surface of land and water, and the visible heavens. The actual drawing of maps and charts is, of course, an art ; but principles such as are involved in the projection of a curved surface on to a plane are properly parts of science, and the only object of a map

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is to give definiteness to a pre-existing mental representation of certain relations of specialised locality.

(b) THE CAUSAL PHYSICAL SCIENCES.

Causal physics itself comprises a relatively formal division, dynamics, together with a higher branch, which is causal in the fullest physical sense of the term, and may be termed "energetics."

DYNAMICS = the science of motion and equilibrium, and of forces considered solely as to their place of application, their direction, and their magnitude.

Dynamics is divisible into two parts, as follows:—

KINETICS = the science of motion.

STATICS = the science of forces in equilibrium.

ENERGETICS = the science of the modes of energy, such as gravitation, cohesion, heat, light, and electricity. Each of these modes may be studied in itself, and energetics is thus divisible into various subordinate sciences; but the ultimate classification of these sciences must be left for the physicist of the future to determine. We do not know that the now recognised modes of energy are the sole modes; for it is only very recently that our knowledge of these modes has been added to by the discoveries of Röntgen rays, X rays, and the radio-activity of certain forms of matter. Moreover, the true relation of the recognised forms of energy to one another is still involved in great

obscurity, which has not been removed by the famous discovery of the conservation of energy. The quantitative equivalence between certain determinate measures of divers modes of energy, and the fact that energy which ceases to appear in a given mode continues its existence in some other mode, do not, by any means, explain the qualitative differences between the modes of energy themselves.

§ 12. *The Abstract Biological Sciences.*

(See Figure 15.)

The facts of number and time apply to the organic circle of object-matter simply in the way that they apply to the inorganic zone. On the other hand, the facts of space and energy, as viewed in relation to the kingdom of organisms, give rise to branches of science which are quite distinct from geometry and physics, though naturally subordinate to one or other of those cosmological sciences. Thus the sectors which in Figure 14 represent number and time are dispensed with in Figure 15, and the whole of the lower quadrant stands for the space relations of organisms or organic factors.

(a) THE FORMAL BIOLOGICAL SCIENCES.

CHOROLOGY = the science of the geographical distribution of organic species, and of the changes which take place, from time to time, in such distribution.

MORPHOLOGY = the science of organic form.
There are four principal sub-divisions of morphology.

CYTOLOGY = the science of cells.

HISTOLOGY = the science of tissues.

ORGANOLOGY = the science of organs.

PICTORIAL BIOLOGY = the science of the external shape and appearance of organisms. In all the branches of morphology it is usual to employ outline drawings or coloured designs to illustrate the organic objects in question; but it is only when whole plants or animals, in their normal living appearance, are represented that the drawings become

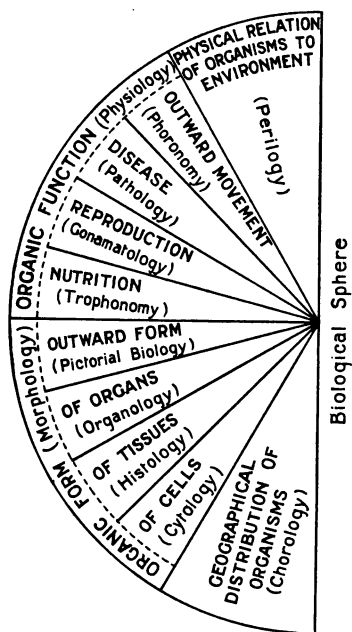


Fig. 15.

pictures in the common sense of the term. This branch of biology could hardly exist without actual pictures; yet it is evident that the actual pictures do not constitute the science—they are merely aids to the logical description of those

external traits whereby the various species of organisms are primarily known.

(*b*) THE CAUSAL BIOLOGICAL SCIENCES.

PHYSIOLOGY = the science of organic function.

Physiology, like morphology, has four principal branches; but these have not, except in one case, any special correspondence to the morphological branches.

TROPHONOMY = the science of nutrition.

GONAMATOLOGY = the science of reproduction.

PATHOLOGY = the science of diseases.

PHORONOMY (corresponding to pictorial biology) = the science of the outward movements of organisms—that is, of their movements through surrounding space. This last is mainly a zoölogical science, but not by any means exclusively so, since the important provisions of nature for disseminating seeds and spores are among the facts to be discussed under this head.

PERIOLOGY (complementary to chorology) = the science of the unconscious relations between organisms and their environment, these relations including the direct effects of environment upon organisms, and those reactions of organisms which are purely physical or reflex. According to this definition, periology includes, at least in their fundamental forms, the theories of natural selection by survival of the fittest and of the adaptation of organisms to their environment.

The foregoing classification of the abstract biological sciences is based partly upon the table given by Professor Haeckel in his *Wonders of Life* (p. 99 of original English edition), but a few of the distinctions which he draws have been omitted as unessential; while *perilogy* (and likewise *œcology* in Section 7) have been limited to connotations more definite than those which he assigns.

It should also be noted that I have not included those branches of biological investigation which Haeckel styles "biogeny" and "ontogeny." This is simply because, while recognising their vast importance, I do not regard them as constituting technically distinct sciences. Every concrete object-matter is studied first in its analysable and classifiable relations as it is normally presented to our observation, while afterwards we pass to the question of its origin and the laws of its growth, both past and potential. Thus in every concrete science there is a preliminary portion which is simply systematic or analytic, and a more advanced portion which is theoretic or synthetic. Growth or evolution is the great object-matter of theoretic science. It is thus not a *distinguishing ground* of science, but forms one, perhaps the most important, of the *uniting principles* of science—that one which was so effectively seized upon by Herbert Spencer in his famous Synthetic Philosophy. I think, then, that biogeny, as treating of organic development,

and ontogeny, as treating of the development of the individual organism, cannot be considered as distinct sciences. *Phylogeny*, on the other hand, may be employed to denote not only the theory of the evolution of species, but the science of actual species, past and present, viewed in their family relationship, as branches of a common stem. In this sense, phylogeny becomes equivalent to biology itself, in its most comprehensive aspect. As such I have already introduced it into the scheme of specialising concrete sciences.

§ 13. *The Zoö-Psychological Sciences.*

(See Figure 16.)

The abstract biological sciences apply to the inner circle of animal life, just as they apply to the outer zone of protists and plants. They do, indeed, become far more complex in their relation to animals; yet they remain essentially the same sciences. It is more especially in the cases of the morphology and physiology of organs and of diseases that the complexity of these sciences, as we pass from the botanical to the zoölogical province, and from the lower to the higher animals, increases. So elaborate is the human organism, and so multifarious are the diseases to which it is liable, that there come to be medical specialists who devote themselves mainly to the study of particular organs, under both normal and morbid conditions, and others who become absorbed in the study of

particular diseases, as affecting the whole organism. There does not, however, appear to be sufficient reason for naming the specialists' branches of organology and pathology as distinct sciences. The medical investigator who interests himself especially in one organ must possess a sound, if less minute, knowledge of all other organs ; while he who concentrates his chief attention on one disease or class of diseases must also be well acquainted with the symptoms of all other recognised complaints.

While, then, morphology and physiology increase in complexity in passing from the botanical to the zoölogical and anthropological spheres, they remain at bottom the same sciences. The abstract sciences which are truly distinctive of the zoölogical sphere are those of a psychological character. It may be that such sciences do not really extend to the circumference of the animal circle, since some of the lower animals may be little, if at all, more sensible of their surroundings than are plants. Nevertheless, the rudiments of the nervous system, together with outward movements which may be broadly classed as purposive, appear very low down in the animal scale ; and, for these reasons, the fundamental psychological sciences may be approximately represented as forming sectors of the zoölogical circle. †Zoö-psychology is equivalent to comparative psychology, in a broad sense of the latter term ; the general standard of comparison

being human consciousness, of which the consciousness of the lower animals falls short in most respects and in all degrees, though, as regards the development of certain senses, such as the hound's keen scent, man himself must take a subordinate place.

(a) CAUSAL PSYCHOLOGY.

This covers all science which treats of consciousness, either as determined by physical conditions or as determining the bodily actions of men and other animals. The former part of causal psychology has two great branches, according as the external stimuli or the internal conditions of consciousness are in question.

PSYCHO-PHYSICS = the science of the external stimuli of consciousness. This includes the modes in which objects affect us through the senses of touch, taste, and smell; but more especially through the crowning senses of seeing and hearing. I say "affect us," as including animals whose senses are comparatively like our own, though the specific effects upon us, as human beings, naturally form the primary data of the science. The tactual sense gives us our fundamental perceptions of extension and solidity, both in our bodies (parts of which meet externally, as in clasping the hands) and in bodies, external to our own, with which we come in contact. This is matter of common sense rather than of exact science. Taste and smell require to be explained by the action of minute particles on the

gustatory and olfactory nerves; but here the process is wrapped in much obscurity, and we have not attained to any exact classification of flavours and odours themselves, such as would form a needful basis for an adequate theory of the external causation

of taste and smell.

With sight and hearing the case is very different; the causes of both form and colour as seen, together with those of sound and musical tones as heard, are, on their objective side, matters of exact science.

OPTICS = the science of the external conditions of seeing; primarily of form and dimension as related to their visual appearance.

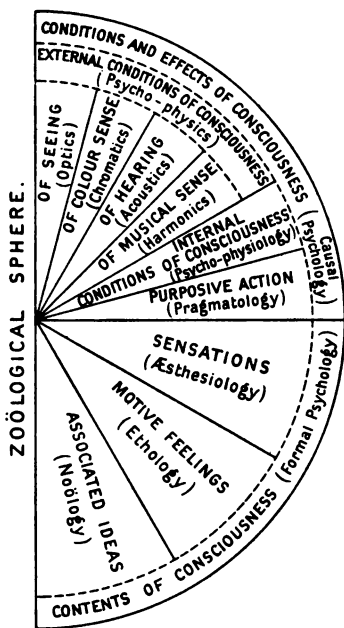


Fig. 16.

CHROMATICS = the science of colour.

ACOUSTICS = the science of hearing, or of sound in general.

HARMONICS = the science of musical tones and their relations in melody and harmony.

PSYCHO-PHYSIOLOGY = the science of the internal conditions of consciousness, or of the functioning of brain, nerves, and auxiliary organs of sense, as concerned in the production of consciousness. This science must be understood to include, and to be based upon, *psycho-morphology*. In some respects, the latter would seem a more appropriate name for the whole science ; since, while the bare fact of consciousness must always depend upon the functioning of the nervous system, the quality of consciousness depends far more upon structure than function. Thus the specific superiority of human consciousness is not due to the human brain functioning in any peculiar way, but rather to the fact of its being in itself more highly organised than the brain of any other terrestrial creature. Given the energy stored in an animal organism, the psychic powers of that organism depend upon the development of its cerebral system, both upon the quantity of grey matter formed in the convoluted cortex of the brain and the complexity of the nerve-centres which are developed and trained to interact therein. In other words, while energy must, of course, be taken for granted, matter and structure are the things specially concerned in the differentiation of a high from a low type of consciousness.

From psycho-physiology we pass to pragmatology.

PRAGMATOLOGY = the science of purposive

action. This is an abstract science which acquires enormous complexity within the anthropological circle, since all practical arts and social institutions are due to purposive action. Within the outer zoölogical circle, however, pragmatology has a comparatively simple object-matter, covering the actions of animals in seeking and storing food, mating and protecting the young, utilising shelters or constructing nests, combating, evading, or fleeing from enemies, and so forth.

(b) FORMAL PSYCHOLOGY.

This department of psychological science treats of the actual contents of the current of consciousness ; of sensation and thought, as such, but not of their physical conditions ; of motive feelings and conscious purposes, as such, but not of their physical effects.

There are three fundamental modes of consciousness, the presence of which can be analytically determined by introspection of the current of one's own consciousness ; while the existence of these modes among the lower animals which possess sense-organs, evince passions, and display intelligence, more or less resembling our own, is a matter of legitimate inference.

ÆSTHESIOLOGY = the science of sensations, as such. Sensations are the immediate appearances in consciousness due to stimuli which affect the *æsthesia*, or sense-centres of the brain, through the

medium of the external sense-organs and afferent nerves. In treating of sensations, as such, we have to abstract, on the one hand, from perceptions, by means of which sensations are intuitively referred to external objects of which, or of the like of which, we have had previous experience. Such objects, as explained in Part I., § 23, are not given in sensation, but are inferred from the mental co-ordination of divers sensations. On the other hand, we have to abstract from feelings of pleasure or pain which accompany sensations. These do not affect the essential, analysable quality of sensations, although intense pain and pleasure of a sensual or strongly emotional character do tend, when present, to distract attention from the purely æsthetic aspect of consciousness.

ETHOLOGY = the science of *motive feelings*. *Emotions* is the commoner term. In practice, however, *emotion* almost always conveys the idea of strong feeling as opposed to mere *sentiment*, and yet is inapplicable to that most intense of all feelings, so-called physical pain—pain caused by some bodily ailment or injury. This is never regarded as an emotion in itself; though the fact of crying with pain, or otherwise manifesting grief on account of it, may be so regarded. Again, *emotion* is apt to signify feeling rather as opposed to, than as leading to, action, and is never allowed to cover volition. For the above reasons I regard emotion as an impossible term, when we wish to

denote all those elements of consciousness which go to make up character, or the moral, in abstraction from the intellectual, side of consciousness. I find a general term for these elements in *motive feeling*. By motive feelings are to be understood desires, volitions, and feelings which involve any degree of pleasure or pain. While pleasure naturally creates a desire for repetition of itself, and pain a desire to be freed from its pangs, I do not think that desire itself can be classed under either of these two heads or regarded as a mere product of either pleasure or pain. Desires have their roots in the instinctive tendencies of the organism. Desire is not normally a creation of experienced pleasure, but rather creates pleasure as the fulfilment of itself, while braving much pain in the pursuit. That conception, however, which represents desire as pain caused by the absence of the desired object is altogether one-sided. Healthy desire is rather a pleasurable anticipation than a painful sense of privation. It becomes painful only when the craving grows out of all proportion to the possibility of satisfying it, or when the means of satisfying it are altogether absent.

While desires of all kinds and degrees are obviously motive feelings, pleasure and pain are also, in fact, motive feelings; for pain, when present, and pleasure, when intermitted, inevitably create a special desire to escape or to renew the familiar feeling.

Desires, as such, may be present without producing action ; since there may be no apparent way of satisfying them, or there may be a conflict of divergent positive desires as to which shall be pursued, or a positive desire may not be strong enough to overcome the negative desire of inertia—the motive to continue resting, or, it may be, to continue moving, without definite purpose. When, however, a desire is enforced by perceiving the means to its realisation, or when one of two conflicting positive desires has overcome the other, or when a positive desire has overcome inertia, so that, in any case, the desire is *on the point of giving rise to* action, we call it a volition. Volition, then, is a form of motive feeling distinguished from simple desire in the following manner: Desire may or may not produce action ; volition *does* produce action, unless opposed by physical constraint.

The above view concedes volition at least to the higher animals, and does not confine it to humanity. That which is peculiar to humanity is *resolution*, or rationally formulated desire. Resolution does not ensure volition, since good resolutions are proverbially liable to be broken—a liability which, we may hope, extends to bad resolutions also. Resolution, however, implies a fully conscious purpose such as cannot exist apart from logical reason. This purpose at least tends to its own realisation, and, in the case of persons of

strong will, all but insures the appropriate action at the right moment.

I have dwelt at some length on these fundamental relations of motive feelings, because the possibility of a genuine science of ethology seems to me to depend on the due recognition of them.

NOÖLOGY = the science of intelligence, or of the association of ideas. When association is due to some actual sensation reviving the memory of similar sensations experienced in the past, or of dissimilar sensations which have in the past been connected with the similar ones, this is a case of perception or perceptual anticipation. When there is no actual sensation, but the memory of some past event, spontaneously appearing, as in a dream, brings other memories in its train, this is a case of imagination of the simplest sort. Lastly, the association of ideas may be due to a sensation or sensuous memory derived from an acted movement or uttered sound which has acquired conventional significance for animals of a given species; although there is nothing in the movement or sound which is intrinsically related to the idea conveyed by its means. This is symbolic ideation, or ideation of the sort which reaches the maximum of rationality in human thought logically expressed.

§ 14. *The Abstract Anthropological Sciences.*

We have seen that the abstract biological sciences acquire a greatly increased complexity as

their application is narrowed from the general biological to the higher zoölogical province; but that, nevertheless, they remain essentially the same sciences. Similarly, the zoö-psychological sciences reach their highest complexity in relation to humanity; yet they do not, on that account, cease to be the same sciences which we have considered in relation to animal consciousness at large. The responses to the stimuli of light and sound, the organs of sense and the nervous system, the facts of purposive action, the fundamental phases of consciousness—sensations, motive feelings, and associated ideas—are all possessed in common by man and the higher groups of non-human animals.

Thus psychology, as such, in all its principal branches, is an abstract zoölogical, not an abstract anthropological, science. The only abstract sciences which are truly distinctive of humanity are those which treat of the various departments of civilisation and of culture respectively. But what is civilisation, and what is culture? These familiar terms are seldom clearly defined, but the senses in which I intend to use them may be explained as follows :—

Civilisation = the practical condition of advanced human communities; embracing, on the one hand, a high development of those industrial arts which appropriate the objects and forces of nature for the maintenance and embellishment of human life, and, on the other hand, a corresponding development

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of government and social organisation, whereby the conflicting passions and interests of individuals are commonly over-ruled for what is, on the whole, the good of the community at large. †

Culture = the psychical (or æsthetic, moral, and intellectual) condition of advanced human communities; that which is evidenced in fine art, literature, moral sentiment, theoretical science, religious opinion, and philosophy.

Thus civilisation and culture are distinct complementary aspects of the life of the higher human communities. The former is necessary to their very existence. The latter is essential to their dignity and true happiness. The leaders of civilisation, in its technical sense, are legislators, judges, officers of State, political reformers, practical inventors, and organisers of industry. The leaders of culture are poets, artists, scientists, scholars, philosophers, and, in the earlier stages of history, prophets and priests. The general ideal of civilisation is utility, while the ideals of culture—not always harmoniously blended—are beauty, goodness, and truth.

To civilisation we owe the more indispensable products of invention and industry, such as clothes, houses, and furniture. To culture we owe the less indispensable, but more ennobling, possessions, such as books, pictures, and music. Culture reacts upon civilisation by demanding a certain standard of fitness and beauty in architecture,

dress, and furnishing. Civilisation reacts upon culture by multiplying the means of culture, as by printing and binding books, reproducing pictures, and constructing musical instruments.

The morality demanded by civilisation, as such, is neither more nor less than that which the laws of the community are designed to enforce. The morality yielded by culture, in its ethical phase, is obedience to an inward law which is acknowledged irrespective of social constraint—a law which tends to prevent those numberless petty transgressions which must always lie beyond the range of legal action, and to promote those numberless acts of kindness and helpfulness for which there is no externally recognised obligation. Thus culture, as I understand it, includes morality, and is not to be opposed to conduct in the way in which Matthew Arnold opposes Hellenism to Hebraism.

On the intellectual side, civilisation includes the application of science to practical purposes, while it reacts upon pure science by the multiplication of scientific instruments and appliances. In itself, however, science is a department of culture. The essential object of the cosmological and biological sciences is one with the essential object of philosophy. Every branch of knowledge seeks truth—the truth relevant to its particular object-matter. From such truth utility may happen to accrue, but no sincere man of science attempts to measure truth by any utilitarian standard.

The whole science of civilisation may be classed as causal psychology ; the whole science of culture, as formal psychology. The progress of civilisation, as such, is primarily due to economic and political causes, involving the element of human consciousness in its respective relations to material objects and social facts. In the order of causal antecedence culture is dependent on civilisation. A certain accumulation of wealth and a certain measure of settled government are its necessary conditions. Culture, as utilised—for instance, science as applied to practical purposes—is a secondary and higher department of civilisation ; but culture, as such, is not causal—not a means to any ulterior end : its end lies in itself. It is a direct satisfaction to the individual who attains it—a satisfaction not lessened, but increased, when he succeeds in transmitting it to others. This is as true of scientific and philosophic knowledge as it is of painting and imaginative literature ; and no less true is it of the moral culture which devotes self to the service of man, and finds its reward even in martyrdom. For æsthetic perception, the beautiful is all-sufficing ; for intellect, truth is supreme ; for the moral sense, goodness is divine—not less, but greater, than the universe itself : not less than God, but God in very deed.

Great as the value of the æsthetic phase of culture may be, it can have no claim, such as truth and goodness respectively possess, to afford an all-embracing ideal. Pure æstheticism can in no way

comprehend either the sphere of intellectual or that of moral culture. On the other hand, the culture of intellect is all-embracing in its own symbolic way, and moral culture is all-embracing in its own practical way. Intellect symbolically includes æsthetic culture by means of the philosophic theory of the beautiful. Morality practically includes æsthetic culture by the fact of assigning to it a certain position in the whole conduct of life. The supreme ideal of culture is thus twofold, rather than threefold; an ideal of Truth and Goodness, both comprehending the ideal of beauty, but each making that ideal subordinate to itself. As between the culture of mind and that of character, there are local, temporary, and temperamental oppositions; but it must not be forgotten that truth and goodness are essentially interdependent. The love of truth is a part of goodness, second only to the love of humanity. Goodness itself is absolutely dependent upon that part of truth which provides an intellectual representation of what is good to be done. Apart from such intellectual representation, an outwardly good action is simply automatic, and has no more virtue than the action of a stone in obeying the law of gravity; while, if the intellectual representation be not true—if, for instance, ruthless persecution be represented as a solemn duty—then the action itself is the reverse of good.

Both civilisation and culture are divisible into

various departments ; and, in either case, each of these various departments may be viewed in a fourfold light : (1) as having an origin and history in the past ; (2) as having an actual existence in the present ; (3) as destined to have a future evolution, in accordance with certain laws of social causation ; (4) as being an object-matter of critical judgment, which approves of some, and disapproves of other, of the facts of social life as at present constituted ; or which, while approving some of such facts provisionally, nevertheless contrasts them with its own ideal of what they ought to become. The third and fourth points of view suggest the difference between the would-be rigid determinism of positive science and the would-be boundless freedom of the philosophic ideal ; but they are not so irreconcilable as they sometimes seem. Critical judgment is a factor in human evolution whose influence is constantly increasing, and must increase in proportion as the proletariat is at once educated and enfranchised. A would-be scientific prognosticator who should ignore this pregnant truth would as certainly fail to foresee the positive destiny of the race, as an impulsive idealist, who ignores natural laws and spurns at the slow action of economic and political forces, fails to realise his Utopian projects. No man ought to occupy a purely positive attitude as to what concerns the welfare of humanity. We ought not to view the problems to which civilisation and

culture have given rise as affairs to be solved by an impersonal process of evolution which we can neither help nor hinder. We ought, rather, to assist in the right solution of those problems by seriously considering what is best for humanity, and throwing our whole energy into the promotion of that which we sincerely conclude to be best. It is, indeed, better to be too sanguine as a reformer than to be a mere apathetic spectator of the force which reformers wield. It is best of all, if it be possible, to combine the highest ideal of human well-being, and the greatest ardour to assist in its realisation, with the most extensive knowledge of those sociological laws which forbid the sudden establishment of Utopias, but may, nevertheless, when properly understood, be pressed into the service of social reform, even as the laws of physical nature have been pressed into the service of industrial progress.

§ 15. *Sciences of the Departments of Civilisation.*

(See Figure 17, p. 193.)

The practical arts and institutions of human society are, all of them, instances of purposive action; so that the science of civilisation must be regarded as a development of pragmatology. The sector which, in Figure 16, represents purposive action may therefore be imagined to expand in Figure 17, so as to occupy the whole of the quadrant standing for object-matter of causal

psychology. Psycho-physics and psycho-physiology pertain to man as an animal organism, and may be left out of account when, as now, we concentrate our attention on man as a civilised being.

An adequate classification of the departments of civilisation would require a work to itself—a work in which one might strive to show, that civilisation, like knowledge, is tending to become—though it is still very far from being—a perfectly organised whole, capable of indefinite growth, but not of indefinite change as regards the relations of its closely connected parts. This “Anatomy of Civilisation” has still to be written, and its scope can barely be indicated in the present pages.

Broadly speaking, we may divide civilisation into two fundamental departments, consisting of physical arts and social institutions respectively. Each of these departments may be then subdivided; physical arts embracing, on the one hand, the practical or life-sustaining and life-assisting arts, and, on the other hand, the athletic and recreative arts; while social institutions are either governmental, as being directly organised by the State, or non-governmental, as in the case of commercial and domestic customs, which, though frequently and in various ways regulated by the State, are mainly due to the voluntary action of individuals, prompted by personal desires and conditioned by social opinion.

ABSTRACT TECHNOLOGY = the science of the

physical arts of civilisation. The arts in question are so numerous and diversified that it is not usual to consider them together, except in a broadly outlined way in treatises of anthropology, of which abstract technology forms a section. While each of these arts involves some method of bodily action, to be learnt by apprenticeship or training rather than from books, many of them are, in fact, applied sciences, demanding theoretical as well as practical knowledge, and each having a literature of its own in the shape of handbooks designed to assist the practical learner.

Abstract technology is, of course, mainly concerned with the various industrial arts; but it may be regarded as also covering the arts of physical recreation and exhibitions of physical skill. Athletic exercises, games, and contests, together with billiards and feats of equilibration or jugglery,

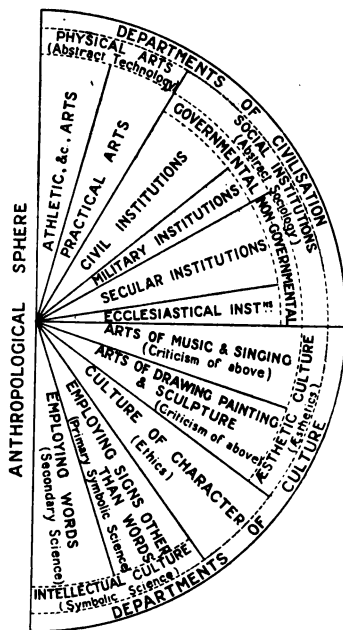


Fig. 17.

which involve a nicety of adjustment between perception and muscular response, are in themselves almost wholly dependent on physical adaptations and independent of intellect. Nevertheless, they form a favourite object-matter of popular discussion and speculation. Their technicalities are treated of by expert critics as well as exhibited by expert professionals, and they bulk prodigiously in the daily press. Allied to these recreative physical arts is the *technique* of the fine arts; though the fine arts themselves are much less exhibitions of objective skill than appeals to subjective consciousness, in which aspect they will be referred to later.

The practical arts are frequently grouped under the two main heads of production and distribution; but this classification is hardly exhaustive, and I would suggest the following seven divisions:—

(1) The most primitive practical arts are those whereby man appropriates the objects of wild organic nature for food or other purposes, without attempting to cultivate their species. Hunting, trapping, and fishing, are activities of this kind.

(2) A second and much more important division of practical art consists in the cultivation of vegetable or animal species to minister perennially to human needs. This covers agriculture, in its many phases, forestry and horticulture, the pasturing of flocks and herds, the breeding of domestic animals, the preserving of game, and pisciculture.

(3) We next come to an important group of arts which appropriate the mineral wealth of nature, without effecting any change in its character beyond what is necessitated by taking or breaking it away from its natural setting. The digging of sand, clay, and gravel, the quarrying of chalk, stone, and slate, mining in its many forms, the sifting of alluvial earth for gold or precious stones, the sinking of wells to procure water or rock-oil, are arts which all belong to this division.

(4) By far the greater number of practical arts, however, consist in the modes of manufacturing or adapting to human use the products obtained by the three preceding groups of activities. These arts of artificial production fall under four heads.

(a) First, we have the preparing or producing of objects of direct human use, or which, at least, are desiderated in themselves:—the cooking of food; the making of beverages and drugs; the building of houses, vehicles, boats, and ships; the fashioning of articles of clothing and furniture, tools, weapons, and other objects of personal or domestic utility; the printing of books and reproducing of pictures, etc.

(b) Secondly, there is a great group of industrial arts which stop short at the production of what are relatively raw materials, needing to be submitted to some further process or processes before they acquire direct human utility. The grinding of corn, the extraction of metals from metallic ores,

the spinning of thread, the weaving of fabrics, the manufacturing of bricks, slates, and other builders' materials, the producing of coal gas and artificial fuels, fall under this second head.

It will be noted that, in general, the products under (*a*) are distinct objects having individualised forms, while those under (*b*) are substances devoid of individualised forms, being valued and distributed by weight or measure. There are, however, exceptions on both sides ; for instance, beverages in the case of (*a*), and bricks in the case of (*b*).

(*c*) Thirdly, we come to the manufacture of machinery and of mills or engines for utilising the forces of wind, water, steam, electricity, explosives, etc. This group of manufacturing arts is the one most distinctive of modern civilisation. It has transformed the methods of production in almost all productive departments, has enormously increased the possibilities of travelling, commerce, and communication by sea and land, and has revolutionised the art of warfare.

(*d*) Lastly, we have the group of arts which employ materials or machines to produce artificially forms of physical energy directly or indirectly serviceable to man. The most ancient and still most important of these arts is the production of fire ; while modern developments in the same direction consist in the superintending of steam engines and of electrical apparatus for motor, lighting, telegraphic, and other purposes.

(5) The four sorts of artificial production so far considered are of a kind to be carried on at any part of the earth's habitable surface. In this respect they contrast with the arts which deliberately, and otherwise than by simple agriculture or forestry, affect the surface of the earth in its specialised geographical extent. These arts are commonly comprised under the head of civil engineering, and include the making of roads, railroads, canals, embankments, artificial harbours, systems of irrigation and drainage, of water and gas supply, and of electric wires and cables.

The preceding groups of practical activities are concerned either with the obtaining or the artificial producing of things. Those which remain to be considered have to do with the distributing or using of that which is wrested from nature or formed by human ingenuity.

(6) The primary practical arts concerned in distribution are the *methods of carrying*, which apply, with minor differences, to goods and passengers alike. Navigation is the art of this description which involves, on the part of navigating officers, the greatest responsibility and most careful application of scientific knowledge. The conducting of trains and the driving of public or private vehicles are occupations falling under the same general category; and even the errand-boy who carries parcels from shop-keeper to customer thereby practises an art of distribution.

There are various arts, mostly, but not wholly, mechanical, which are subsidiary to distribution proper ; such as sorting, packing, parcelling, loading and unloading, storing goods in warehouses, and displaying them for sale. Actual buying and selling, together with the keeping of accounts and methods of advertising, are abstract sociological, not physical, arts.

(7) There is a last group of practical activities, concerned neither with production nor with distribution, but simply with the use or preservation of that which has been produced and distributed. These include the elementary arts of civilisation, such as dressing, and feeding with knife and fork, to which every normal person becomes accustomed. There are, however, many allied activities which may be practised either *by* one's self or *for* one's self by another person ; the latter being either a hired servant or simply a renderer of services, professional or gratuitous, as the case may be. Hair-cutting, laundry work, house-cleaning, and waiting at table are cases in point ; while the repairing of houses, clothes, and other objects (though in itself semi-productive) may, on the whole, be classed with these arts of service.

ABSTRACT SOCIOLOGY = the science of social institutions ; that is to say, of the arts and customs which involve relations of human beings to one another rather than to objects of their non-human environment. In many of the technological arts

we have physical co-operation of several persons, as of oarsmen rowing together ; but this is not a social relation in the strict sense, since, for instance, the object of the rowers is not to do anything one to another, but simply to unite in propelling the boat.

Social institutions are, as already stated, divisible into two groups, governmental and non-governmental respectively. As the world is now constituted, political power is centred in a number of distinct national governments, between which there are casual alliances and *ententes*, alternating with periods of rivalry and friction which frequently end in the wholesale massacres of modern scientific warfare. Thus governmental institutions must still be divided into civil and military branches ; they will continue thus until there is established an International Authority, representing, not merely the national governments of the time being, but the people themselves of all civilised nations. Under such an authority general disarmament would be possible, a mere remnant of the armies and navies which now exist surviving as an international police force.

Of civil polity there are three great branches : (1) legislature—the method employed in the making of laws ; (2) judicature—the method of administering laws by the intellectual processes of obtaining evidence and giving judgment ; (3) police institutions, which employ physical force

for the carrying out of judicial decrees, the arresting of suspected persons, and the maintenance of law and order in public places.

As the governmental institutions at present existing are either civil or military, so the non-governmental ones are either secular or ecclesiastical. Although the Established Churches are recognised by the governing authorities, they are not essentially governmental institutions, and it is widely held that whatever good Churches and sects may do is better done by influencing individual opinion and conduct than by interfering with the State's functions. Even as non-governmental institutions, however, their utility is very questionable from a secular point of view. Their *raison d'être*, in Christian countries, is the assumed existence of an anthropomorphic God, who has revealed his will in the Bible, and especially in the life, death, and resurrection of Christ, as recorded in the New Testament and symbolised in ecclesiastical ritual. If this traditional view of God's relation to man be generally discredited, as it has been by many of the foremost thinkers of modern times, the Churches must either cease to exist or undergo a revolutionary change hardly possible to conceive in connection with such conservative institutions. No doubt these organisations have a value in promoting social intercourse, in combining moral with æsthetic culture, and, in a less degree, with that intellectual culture which enlightened preachers

manage to convey at the constant risk of being regarded as heretical. Nevertheless, the great ecclesiastical bodies avowedly subordinate moral and intellectual culture to supernatural religion. They exist to acclaim and propitiate an externally-conceived God. If, then, the Ideal of linked Goodness and Truth which is *in* man is the one thing knowably divine; if the mysterious Spirit of Man and the mysterious Process of Nature are venerable only because they give birth, the one proximately, the other ultimately, to this great Ideal, it is clear that the Churches must either recast their dogmas or be superseded by new and non-ecclesiastical organisations. These would exist avowedly to promote culture, moral and intellectual; at the same time either disclaiming religion or proclaiming a natural religion of the Ideal in opposition to all supernatural creeds.

Among social institutions which are at once non-governmental and secular, we may distinguish six groups: (1) domestic institutions, embracing marriage customs, relations of parents to children, etc.; (2) commercial institutions, covering wholesale and retail trading, finance, and account-keeping; (3) medical institutions, mainly consisting in the practice of physic and surgery, and the methods of qualifying students for such practice, but which may be taken to include, as practices subordinate to medicine proper, the professional nursing of the sick and custodianship

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of the insane, together with sanitary inspection, and any measures taken to prevent the spread of disease or otherwise increase the health of the community ; (4) academic institutions, embracing all means for the teaching of general knowledge and of those arts which are not strictly technological, political, or medical—means ranging from elementary schools to universities ; (5) humane institutions, the chief of which are those which afford maintenance to persons who, from their immature youth, their advanced age, or their diseased conditions of body or brain, are incapable of supporting themselves, and are also without near relatives capable of maintaining them ; (6) propagandist institutions, or those which exist to promote special lines of political action, of social reform, or of philosophic or hygienic opinion as apart from ecclesiastical dogma.

§ 16. *Sciences of the Departments of Culture.*

(See Figure 17, p. 193.)

Of the three great branches of culture—the æsthetic, the moral, and the intellectual—the two first have sciences, or sections of philosophy, proper to themselves ; but the third is approached by a whole group of sciences, having to do with different aspects of man's many-sided mind, though there are certain principles common to all of them.

ÆSTHETICS=the science of æsthetic culture. It is, no doubt, more usual to speak of æsthetics as

“ the philosophy of the beautiful ”; but the beautiful is practically included within the sphere of æsthetic culture. Although we may attribute loveliness or sublimity to certain physical objects, it is evident that these attributes do not belong to the objects in their physical relation to other objects—not even in their physical relation to our own organs of sense. They belong to the objects in so far as their form, colour, texture, magnitude, or distribution in the field of vision is such as to create in us certain sensuous impressions which are accompanied by a feeling of admiration. Thus the beauty of a real or of a living object does not differ essentially from the beauty of a pictured or sculptured object, except that the human and other organic forms have endless aspects of which only one at a time can be pictured ; while men and other animals possess endless capabilities of posture and action of which only one at a time can be represented, whether in painting or sculpture. On the whole, we may take the sculpture and painting of any given people and period as indicating and interpreting a corresponding perception of the beautiful in visible nature ; so that the history and criticism of these arts is inseparable from the history and criticism of man’s sense of the beautiful. In the case of pleasing sounds, it is still more evident that the theory of the beautiful is inseparable from the history and criticism of the art of music, which not only interprets, but largely creates, the natural beauty of

melodious sequence and changeful harmony, only the bare rudiments of which are to be met with in the sounds of wild nature.

Painting and sculpture do not appeal solely to the sense of visual beauty and fitness. They appeal, also, to imagination, and, through imagination, to moral sentiment ; but any didactic quality which they possess is properly subordinate to their æsthetic quality. The artist may aim to instil a truth which might be expressed in words, but the truth at which he primarily aims is truth to the visual aspect of nature, which cannot be nearly so well expressed in words as by physical images ; not truth to the concrete-abstract reality of things, of which language, scientifically employed, is the fittest symbol.

ETHICS = the science of moral culture or of ideal character. While the science of ethology treats of all motive feelings, as they actually exist, and of the actual combinations of motive feelings which produce divers characters, ethics distinguishes, in motive feelings, between the right and the wrong, and, also, between those which are essentially good and ought to predominate in man's character and those which are good only when held in subordination to the higher ones.

SYMBOLIC SCIENCE = the science of intellectual culture ; the culture, or deliberate cultivation, of intellect being always dependent on the use of signs, or symbols, of one kind or another. These frequently possess a certain resemblance to the

things signified, or symbolised. For instance, primitive picture-writing and imitative gesture-language possess some such resemblance. Even in these cases, however, the symbols *mean* much more than they actually *show*; while the highest symbols, such as those of true, or phonetic, language, come to *mean* all without *showing* anything. In other words, names and statements evoke the ideas of things in all their known variety and relations, though they themselves bear no resemblance either to the primary object-matters thought about, or, for that matter, to the notions subjectively evoked by their own means; which notions are, as argued in Part I., intelligent references rather than actual resemblances to things. By far the most important section of symbolic science is that which treats of intellectual culture as embodied in spoken and written language. To this *secondary* science the following section will be devoted. There are, however, several sorts of symbols, of varying degrees of importance, which lie outside the sphere of significant words. Arithmetical notation and algebraical signs are perhaps the most important of these. Then we have musical notation—of less practical, but of greater æsthetic, value. The language of gesture is very widely, if not universally, understood, and is sometimes practically serviceable to persons who are ignorant of one another's modes of speech. Gesture language is, of course, largely

employed by actors ; but all ordinary action on the stage, which has an assumed purpose or expresses an assumed state of mind, is intellectually symbolic as well as æsthetically representative. Again, the art of the conjurer consists mainly in presenting to his audience cunningly-contrived symbols of that which does not exist. Pure sleight of hand, which deceives the onlooker through movements too rapid to be followed by the eye, is a physical art ; but the greater part of the conjurer's mystery is practised on the intellect, by causing erroneous ideas to be attached to the objects and processes which he exhibits. Other symbolic arts are games, like chess, played with "men" on boards, or, like cards and dominoes, with numbered objects. The "men" and the cards resemble words in having conferred on them a conventional value or conventional powers which do not belong to them as physical object-matters.

§ 17. *The Secondary Sciences.*

(See Figure 18.)

SECONDARY SCIENCE = the science of language as embodying thought = the science of thought as embodied in language. When verbal expression is the chief object-matter of inquiry, secondary science becomes *extrinsic*; when thought, rather than language, is studied, it becomes *intrinsic*. There is here a modal polarity—no substantial distinction—in the object-matter. The most

pedantic philologist must have some regard to the inner meanings of words. The most romantic metaphysician, as well as the writer of avowed romance, must give a certain consideration to the explicit forms in which his thoughts take shape. There is, however, a very practical distinction between the study of the linguistic (or extrinsic) aspect and that of the significant (or intrinsic) aspect of expressed thought.

While the individual mind is, in its relatively subjective way, microcosmic, reflecting as much of the universe as its own experience, its assimilated book-learning, and its capacity for constructing ideal experience on rational lines enable it to do, the sphere of human thought, expressed in works of literature and science, is microcosmic in a relatively objective sense. It contains a far more particularised record of man's actual and potential relations to the cosmic process than individual reason can achieve. There are no elements in the experience of any men which are not referred to within it; and no realities can be truly known save those to which it—explicit thought—stands as the symbol and means of introduction. The symbols other than those of thought, which were mentioned at the close of the last section, refer to restricted object-matters only. By arithmetical notation and algebraic signs we may symbolise quantitative relations, but qualitative relations and their nucleation in concrete objects must be symbolised

logically or not at all. Moreover, quantitative relations and the machinery of arithmetic-algebra are both subsumed under logical modes of expression, and it is only in the purely mechanical processes of mathematics that the juxtaposition of digits is found to be more serviceable than that of words. Thus significant language affords the supreme and universal system of symbolism; and those symbols which are non-logical, as well as those things which are non-symbolic, are alike represented in thought. Finally, thought reflects upon itself; in grammar and philology, upon its inseparable instrument, language; in criticism and logic, upon itself as the essential significance of language.

This reflecting of thought upon itself gives rise to secondary science, and, although secondary science treats of only one of the departments of culture, this department stands in a unique relation, not only to man's whole nature, but to the known universe. It forms at once an object-matter and the sum of subject-matter. It epitomises, in a mode of its own, the whole primary object-matter of science, concrete and abstract alike. Hence the science of this secondary object-matter becomes *secondary* science, and all other science whatsoever remains *primary* science.

For convenience sake, the sector which, in Figure 17, represents the object-matter of secondary science is, in Figure 18, expanded so as to occupy

a whole quadrant. It must, however, be understood that secondary science, in spite of its great importance, cannot really take the place of æsthesiology, ethology, æsthetics, and ethics.

Extrinsic secondary science, or the study of the arts of language, in abstraction from the inner meanings of thought, is either analytic or synthetic.

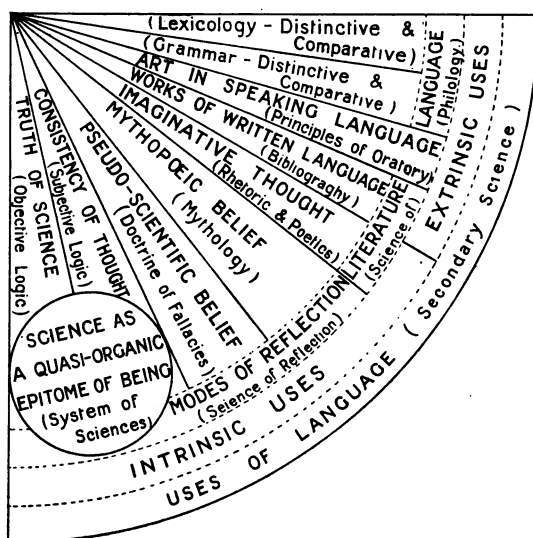


Fig. 18.

The analytic branch has to do with the structure of words and sentences; the synthetic branch, with the building up of discourse in prolonged speech and literature.

PHILOLOGY = the analytic branch of extrinsic secondary science. It may be divided into (1)

lexicology, which treats of the spelling and derivation of words, and gives, by means of synonyms or synonymous phrases, the more obvious or generally recognised (though often equivocal) meanings which they convey; (2) *grammar*, which discusses the parts of speech, their inflexions, and the correct methods of combining them in sentences. Prosody may be subsumed under grammar, in its widest sense.

There is a cross-division of philology, according as one particular language, or the relationship between various languages, is in question. In the former case, both lexicography and grammar may be termed *distinctive*; in the latter case they both become *comparative*.

The synthetic branch of extrinsic secondary science consists in (1) *the history and principles of oratory*, or of the art of extended speaking; and (2) *bibliography*, or the science of the works of literature, which may be considered either in a doubly specialised aspect, as particular manuscripts and editions, or in a simply specialised aspect, as particular products of individual minds, capable of indefinite reproduction in written or printed form.

Intrinsic secondary science, or the study of thought, belief, and knowledge, has, like the extrinsic departments, two main sub-divisions. In this case, the principle of division is, in itself, intrinsic, being dependent on the conscious intention of the thinker, according as he gives free play

to wit or imagination, without attempting to state literal truth, or, on the other hand, soberly inquires and reflects, with a view to ascertaining what is knowably or probably true. In the early stages of historical culture, as well as in the under-cultured condition of intelligence in the present day, men fail to draw any clear distinction between that which they merely imagine and that which they soberly conceive, so that a pseudo-belief attaches to almost anything which they manage to express in words. When once, however, culture has reached the stage of clearly distinguishing between the *play*¹ and the *work* of the mind, all thought which does not pretend to literal truth falls under the former category, and all which does pretend to literal truth, no matter how fanciful in origin, must be considered as *serious* unless or until its fanciful character can be detected.

THE SCIENCE OF IMAGINATION = that branch of intrinsic secondary science which treats of speech and literature as tending to arouse vivid ideas, without the attempted formulation of definite beliefs. Imagination, as embodied in language, has two aspects: analytic and synthetic. In the analytic aspect it is marked by telling figures of speech, these forming the object-matter of *rhetoric*, as apart

¹ Such play, of course, becomes work to the professional novelist or writer of imaginative literature; but it remains essentially play of the mind, just as the work of the professional cricketer remains essentially play of the body.

from mere oratory. In the synthetic aspect it is manifested by a sustained construction of plot and delineation of characters, such as belongs to epic poetry, drama, and romance; these desiderata being discussed by *poetics*, as apart from mere prosody.

THE SCIENCE OF LITERATURE may be considered to overlap the dividing line between the extrinsic and intrinsic secondary sciences, being partly concerned with bibliography, and partly with the imaginative or literary, as opposed to the purely scientific, quality of books.

THE SCIENCE OF REFLECTION = the science of thought which either formulates definite beliefs, or inquires into and discusses matters with a view to so doing. In the light of rational criticism the modes of reflection are either invalid or valid; the invalid ones comprising myth, or legend, and pseudo-science; the valid ones comprising logical consistency and scientific truth to nature.

MYTHOLOGY = the science of mythopœic beliefs, which appear to arise mainly from attempts to explain the order of nature in terms of human volition and action, although I think there is also a good deal to be said for Max Müller's (one might add Matthew Arnold's and Wendell Holmes's) views of the direct influence of language on thought; that which the creative mind states by way of vivid metaphor being in time accepted by the unimagi-native multitude as rigid dogma.

DOCTRINE OF FALLACIES = the science of pseudo-scientific beliefs. It is usual to append some dissertation on fallacies to treatises of logic; but the rationalistic criticism of recent times has found a much wider sphere of inquiry into fallacies, as well as into downright myths, than professional logicians have allowed themselves to contemplate. Take, for instance, Mr. John M. Robertson's *Letters on Reasoning*, and the many astute criticisms of illogical arguments and equivocal statements which appear in other works by the same author.

To Comte is due the merit of having observed three great stages in the evolution of the human mind: the mythopœic (to say "mythological" is to confuse subject-matter with object-matter), the metaphysical (I should prefer to call it simply sophistical), and the scientific. In the light of modern psychology, we cannot draw the line between the metaphysical and the scientific stages quite where Comte drew it; but the broad distinction holds good. *Doctrine of fallacies* has largely to do with the sophistical, or so-called metaphysical, stage of thought, which occurs when primitive myths are no longer literally believed; but verbal compromises, ascribing real causation to abstract entities (or to a Deity who has become an abstract entity), have taken their place.

SUBJECTIVE LOGIC = deductive logic = formal logic = the science of the syllogism, or of correct

argument from given premises. It is the science of terms and propositions, in so far as an understanding of these is necessary to the understanding of arguments; but, in so far as terms *name things* and propositions *state facts*, terms and propositions become object-matters of objective logic.

OBJECTIVE LOGIC = the science of subject-matter in relation to real object-matter. Mythology and doctrine of fallacies are concerned with the relation of subject-matter to hypothetical object-matter; but in these cases the object-matter is concluded to be unreal. Thus these departments of science form the reverse, or negative, aspect of a mental discipline of which objective logic is the obverse, or positive, aspect. In objective logic—or call it philosophy of science—the object-matter is inferred to be real, and the marks of its reality (or of the truth of the statements about it) take the place which the criteria of consistent argument occupy in subjective logic. Objective logic *is* secondary science, but is *not merely* secondary science. It is also, when taken in its necessary connection with subjective logic, the abstract and epitome of primary science, and, through primary science, of the known universe. In Figure 18 these relations are represented by the small circle which stands for the unified sciences, as being at once object-matter of the system of science (a part of logic) and subject-matter referring to the whole system of Nature.

As explained in § 5 (p. 127), the names of sciences which appear in parentheses throughout the diagrams of which I have made use are properly transferable to this inner eccentric circle, since the sciences themselves have no existence outside of man's logical consciousness.

§ 18. *Concluding Remarks.*

My aim throughout the second part of this treatise has been to exhibit the system of the sciences as one section of the whole philosophy of knowledge. I have not attempted to discuss the pedagogic question as to the best method of impressing the broad outlines of science on the plastic minds of the young. There is, however, no need to conceal my conviction that the conception of a universe, as reflected in unified human knowledge, should dominate the intellectual side of education *from the very first*; that every child should be taught to reflect on the relation of living things to the great cosmos from which they spring, on the relation of man to the lower organisms, through some of which he has derived his being, and on the noble ideals of civilisation and culture which crown our human life, without in the least isolating it from the broad realities of its origin and environment.

If I have not attempted to classify the sciences on pedagogic principles, still less have I attempted to classify them on practical principles. What may be the best division of sciences for suiting

the convenience of a body such as the British Association, or for ensuring an economic division of labour between scientific specialists, are very important problems ; but these problems must be left for practical scientists to solve among themselves.

My aim has been not so much to show the present and practical divisions of science as to exhibit all the main divisions which are possible—divisions within or between which all future developments of science are bound to fall. The system adopted in Part II. follows from the principles explained in Part I. Commencing with the sciences whose object-matters have the greatest extension, I have worked inwards to those whose object-matters have the greatest intension, and this process has been repeated four times : firstly, in the case of the Fundamental Concrete Sciences (§ 7) ; secondly, in that of the Specialising Concrete Sciences (§ 8) ; thirdly, in that of the Generalising Concrete Sciences (§ 9) ; and, fourthly, in that of the Abstract Sciences (§§ 10 to 17). In the three latter cases it may be said that the ground covered in the fundamental scheme has been simply re-surveyed in particular aspects, due to considering, first, the uniqueness of the known universe ; second, the concrete uniformities among objects ; third, the distinct relations centred in objects. In the case of the abstract sciences, the progress from greater extension to greater intension is not invariably observed ; but it is followed on the

whole. Arithmetic and chronology, with which the series of abstract science commences, have object-matters of universal extension with almost no intension; while logic has, in human knowledge, an object-matter of the greatest possible *abstract* intension, symbolising the greatest known intension (as well as extension) of concrete reality.

I do not for a moment contend that my classification of the sciences does not need revision in detail, or may not be improved upon by persons better acquainted than myself with particular branches of science; but I do claim that the broad features of the scheme are permanent, and cannot be affected by the future progress of science along the legitimate lines of observation, experiment, analysis, and synthesis. The main departments of concrete science—cosmology, biology, zoology, and anthropology—will possess their distinctive object-matters at least as long as man possesses terrestrial existence; and, so long as sensuous experience and logical understanding remain, there will be the modal divisions of science into the concrete and the abstract spheres, with that of concrete science into its specialising¹ and generalising

¹ There are, as already shown, specialising abstract, as well as specialising concrete, sciences. Chronology, chartography, chorology, and the histories of the various departments of civilisation and culture are cases in point. The distinction, however, between specialising and generalising branches is less relevant to the classification of the abstract sciences than to that of the concrete ones.

branches, and that of abstract science into its causal and formal, its physical and psychological, branches; while the whole of science will be always divisible into primary and secondary departments.

I must not conclude without some allusion to previous classifications of the sciences. At the close of his *Grammar of Science*, Professor Karl Pearson reviews briefly the several schemes proposed by Francis Bacon, Auguste Comte, and Herbert Spencer, and appends a scheme of his own, which he acknowledges to be of a simply provisional character. In fact, he appears to hold that no individual *can* classify the sciences logically. "An adequate classification," he says, "could only be reached by a group of scientists having a wide appreciation of each other's fields and a thorough knowledge of their own branches of learning. They must further be endowed with sympathy and patience enough to work out a scheme in combination." And, after all this, "their labours would indeed, in course of time, come to have only historic value." I agree with the latter inference, but not with the former statements. A syndicate of scientists might help to determine the practical limits within which each specialist should confine his labours, but it would be no more capable of classifying the sciences logically than it would be competent to produce a unified and consistent system of philosophy; for of such a system the classification of the sciences must

naturally form an integral part. Such a far-reaching analysis as is needed must, like every really important advance or rectification of knowledge, be the consolidated outcome of individual thinking. If I have failed in the attempt, some other individual thinker may succeed; but a syndicate of scientists is never likely to do so. Besides, the only scientists who would have any technical right to approach the problem would be those inquirers—usually described as philosophers rather than as scientists—who have made a special study of knowledge in its relation to known reality. There is a kind of specialism in the effective handling of the more general human ideas, as well as in the effective investigation of the more particular groups of facts.

I do not think it necessary to discuss in much detail the divergence of my own classification of the sciences from previous classifications; but, considering that my use of the terms, *abstract* and *concrete*, as designating groups of sciences, differs considerably from Spencer's, I must, in justice to students of Spencer, endeavour to explain wherein the difference consists.

According to Spencer, the fundamental distinction in science is that between the abstract and the not purely abstract ("abstract-concrete" + "concrete") sciences. His abstract sciences consist solely in mathematics and logic, or, rather, in pure mathematics and subjective (deductive) logic.

There is certainly an important agreement between these supremely generalised branches of knowledge. The forms of deductive argument and the formal operations of arithmetic-algebra hold good, no matter to what object-matters they may be applied; no matter whether the object-matters be objects or attributes, singular or general, sub-individual, individual, or collective; and no matter whether they be real or imaginary. According to my view, however, the universal modes of argument and the universal relations of number are alike originally generalised from our familiarity with real and complex object-matter. In the case of logic, this object-matter is the actual process of human thought as conditioned by human language; while, in the case of arithmetic-algebra, the object-matter includes, not only *all* the immediate contents of consciousness, but also all the inferred objects and objective relations in nature. Therefore I class arithmetic-algebra, together with the mathematics of time, space, and motion, as cosmological sciences, but regard deductive logic as a properly anthropological science. The degrees of distinction (see Part I., § 12) which form the objective basis of subjective logic are indeed cosmological and primary facts; but the types of statement employed in deductive logic, and, consequently, the process of discursive reasoning, are object-matters of secondary science.

I think, then, that the broad distinction between

subjective logic, as of secondary and anthropological reference, and mathematics, as of primary and cosmological reference, is more important even than the agreement (in supreme generality) between these branches of science, which leads Spencer to class them apart from all other sciences whatever. Objective logic forms a bridge between anthropology and cosmology, because it is not concerned solely with the form of thought, nor yet solely with the fact of thought, but takes in as much of the contents of science, and thus envisages as much of the reality of nature, as consists with a concise synoptical view of the whole.

The second great distinction in science which Spencer recognises—a distinction which Professor Karl Pearson practically ignores—is that between abstract-concrete and concrete science. For the most part, my conception of concrete science agrees with Spencer's ; but what he calls abstract-concrete sciences are by me called simply abstract. The distinction which I regard as truly fundamental between concrete and abstract sciences is precisely parallel to the distinction between concrete and abstract object-matters discussed in Part I., § 16. A science is concrete if it discusses objects of a given class in all their ascertainable qualities and relations. It is abstract if it abstracts, for special investigation, from the whole nature of all or of certain objects, some definite attribute (quality or relation) or group of attributes, purposely ignoring

all other attributes which are present, in varying combinations, in the objects themselves. When a complex group of attributes is selected, what I mean by abstract science approximates to Spencer's conception of abstract-concrete science. When the simplest and most universal relations of objects, which may also be relations of attributes themselves, are abstracted, we have what Spencer understands by abstract sciences.

My chief disagreements with Spencer's scheme of the concrete sciences are : (1) that it includes psychology, and (2) that it excludes chemistry. Professor Bain criticised Spencer's classification on both these heads, and Spencer replied in a post-script to his essay, "The Classification of the Sciences";¹ but I do not find his replies convincing. The only sense in which psychology can be thought to be a concrete science is the sense of psycho-physiology; but psycho-physiology does not include the whole of physiology, and still less does it refer to the whole relationship of man. It is therefore properly abstract, according to my definition. As regards chemistry, Spencer is perfectly correct in denying it the position of concrete science, *if* it is to be regarded as concerned solely with chemical elements and compounds, apart from their actual and individualised manifestations in physical objects. In classing chemistry as a generalising concrete

¹ *Essays, Scientific, Political, and Speculative*, vol. ii., p. 104.

science I have not so regarded it. I have assumed that atoms and molecules are real, though ultra-sensible, objects, and that chemistry is theoretically competent to discuss them in all their known relations; not only in their elemental relations, but in the allotropic forms to which they give substance, and in the varying physical conditions in which they are found, and even as constituting living cells. The molecular structure of inorganic masses may be a special object-matter of the physicist, and that of cells a special object-matter of the physiologist; but the chemist himself must naturally have regard to the actual formations, inorganic or normally organic, which he practically analyses into their elements, or practically reproduces by combination of elements.

To approximate my own classification, as far as possible, to Spencer's, it may be said that the definite distinction which I have ventured to draw between the formal and causal groups of abstract science is somewhat analogous to the definite distinction which he draws between abstract and abstract-concrete sciences; but my conception of formal physical science includes the application of mathematics (in mensuration, geography, chronology, etc.) to real space and time, excluding its application to motion and energy; while my notion of formal psychological science includes, not only formal logic, but the whole of psychology as approached introspectively and without

reference to the physical conditions of conscious states.

Professor Karl Pearson's classification of the sciences appears to me to be, on the whole, less valuable than Spencer's. If my principle of arranging sciences according to their object-matters is correct, Professor Pearson's grouping of sciences into *precise* and *synoptical*, which merely expresses a methodological difference in the stage of development to which the respective sciences have attained, is quite irrelevant. In distinguishing between certain concrete sciences which are concerned with "non-recurring phases" and others which are concerned with "recurring phases" of "growth and change," Professor Pearson has, in his own method, forestalled the distinction between specialising and generalising sciences. But, strange to say, he only recognises this distinction in the case of sciences treating of "organic phenomena." If certain phases in the evolution of organic species and of mankind are non-recurring—historical rather than "biological" in the general sense, what can be more obvious than that the growth of particular worlds and systems in stellar space is also non-recurring—historical in the astronomical sense? This growth may, of course, be repeated in general outline; but there is as little or less likelihood of its being repeated in identically similar phases as there is of organic evolution or human history beginning over again, or taking place in some

remote planet, and running the very same course with which phylogeny and history have made us partially familiar.

The application of these concluding remarks has been, so far, confined to the subject-matter of the second part of this essay—the classification of the sciences. I will add little concerning the treatise as a whole, because, as a whole, it is incomplete. Two of the objects with which I set out have been achieved to the best of my ability. My first aim was to show that knowledge resembles the living organism in possessing what may be metaphorically termed a pervading cell-structure; the cell of possible knowledge being the relation of some subject-matter to some (hypothetical) object-matter, while the cell of actual knowledge is the relation of true subject-matter to real object-matter. My second aim has been to show that science in the present day resembles a complex organism—say, a human being at about the period of birth—in that the broad relations of the sciences admit of a clear definition which cannot conceivably be superseded by the future growth of science along these, its already well-established, lines. The various sciences are the organs of knowledge, and the relations of these organs constitute the most obvious features of its *anatomy*. But the whole anatomy of knowledge includes more than this. There are certain “tissues,” or uniting principles, of knowledge which must be thoroughly investigated before the

philosophy of knowledge can be presented as a quite coherent whole. These uniting principles are subjective and universal, respectively; the subjective principles being the methods, including scientific induction, by which the human mind approaches reality; the universal principles being the substance, modality, and relatedness of things, which, including natural causation, are the abiding and compelling features of reality itself.

Although I deem myself in possession of certain genuine clues for exploring the anatomy of knowledge in these, its final, aspects, my opinions touching them are still, to a considerable extent, fluid and unformed. Here are questions demanding more study and thought than I am likely to be able to bestow for many months, or perhaps years, to come. I will not, therefore, apologise for offering to the thinking public the foregoing essay in analysis, together with such conclusions as have been drawn by the way, and such suggestions as have been thrown out concerning that vital re-integration of conduct, arts, institutions, and humanity itself, in the light of fully-organised knowledge, for which a rational philosophy must ever strive.



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